MASTER OF ACCOUNTANCY

An examination of the performance of technical trading rules in Central and Eastern European stock markets

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DECLARATION

I declare that I am the author of this dissertation; that all references cited have been consulted by me; that the work of which this dissertation is a record has been done by me; and that this dissertation has not been previously presented for a degree.

Signature:_____ Date:_____

Sandeep Ramjug

CERTIFICATION

WE CERTIFY THAT Sandeep Ramjug has worked on his research under our supervision and has fulfilled the conditions of the relevant ordinances and regulations of the University of Dundee so that he is eligible to submit the following dissertation in fulfilment of the requirement for the degree of Master of Accountancy.

Signature:_____ Date:_____

Dr Suzanne Fifield

Signature:_____ Date:_____

Dr Bruce Burton

Chapter One

Introduction to the Study

1.1 Introduction

The concept of an efficient capital market has been a hotly debated topic in the academic literature over the years. Fama (1970) pioneered the notion of an efficient capital market. According to his work, which has been widely accepted amongst the finance community, a market is weak form efficient if share prices fully reflect all information that is contained in past price movements. If this is the case, then there is no value in trying to predict future share price movements by analysing past share price changes. However, the validity of this notion has been questioned as several recent studies have shown that the usage of technical trading rules can be used to exploit trends in share price movements to generate abnormal profits (Brock et al., 1992; Hudson et al., 1996; Fifeld et al., 2008).

In the current study, the predictive ability and potential profitability of technical trading rules is analysed. In addition, the dissertation focuses on the emerging markets situated in Central and Eastern Europe (CEE). In particular, the emerging markets studied include Croatia, the Czech Republic, Estonia, Hungary, Poland, Romania, the Russian Federation, Slovenia and Turkey. In total, nine emerging CEE markets are examined over an 11-year period from January 1997 – December 2007. In order to test the weak form of the Efficient Market Hypothesis (EMH), two of the most popular technical trading rules are applied: the filter rule and the moving average rule. The filter rule is defined as buying a share at the start of an upward trend and selling the share at the start of a downward trend. Therefore, the filter rule attempts to exploit any pattern that is imparted in share returns. By contrast, the moving average rule compares the long run moving average of share price with the short run moving average. If the short run moving average is above

(below) the long run moving average then a buy (sell) signal is generated. These technical strategies can be used to inform investors when to buy or sell a security.

There are a number of reasons why these technical trading rules are examined using data for these CEE emerging markets. In recent years, the amount of money which has been invested in these markets has grown considerably. The growth in the popularity of emerging markets in general is due to the potential for excess returns compared to other markets around the world and the potential that they offer to reduce portfolio risk. The high returns coupled with the risk reduction benefits are attractive to investors around the world. In the current dissertation, the markets of Central and Eastern Europe are examined. Although these markets are located in a single geographic region, they vary considerably in terms of age, size, number and spread of securities traded, government regime and economic development. Due to data availability, the markets in the region of Central and Eastern Europe have not been focused on heavily by academics. Therefore, this current dissertation attempts to fill this gap.

There has been extensive recent interest in the extent to which technical trading rules and generate market-beating profits and the study makes a number of contributions in this context. The main aim of this dissertation is to analyse the profitability of the technical trading rules using data for a selection of Central and Eastern European stock markets. Previous studies have tended to focus on developed markets such as the UK and the US, or on a single emerging stock market; the markets examined here have grown greatly in recent years, but research into their pricing behaviour is limited. Second, the study examines the impact of transaction costs on the profitability of the trading strategies; this factor can be very important in developing markets, but many studies fail to incorporate them into the analysis.

Third, two different types of technical trading rules are examined in this study: the filter rule and the moving average rule; early studies of developing markets have tended to use only one rule in a particular market. Finally, it should be noted that the analysis is conducted in terms of both sterling and the local currency in each market; this is a distinctive advantage as it allows determination of whether any of the predictability is related to exchange rate movements. The analysis in sterling was conducted to permit the incorporation of a UK investor perspective.

1.2 A Review of Contents

The remainder of this dissertation is constructed as follows. Chapter 2 provides a review of the previous literature on the application of technical trading rules in financial markets. In particular, the first section of the chapter introduces background information on the EMH, specifically the weak form of the EMH, which is the main focus of this investigation. After this, the use of statistical studies in developed markets is reviewed by looking at early and later evidences concerning the use of the serial correlation coefficient, runs and variance ratio tests. This review is provided to give a background as to how these tests were used and what conclusions were reached. In the next section, early and more recent evidences concerning the performance of both the filter and the moving average rule are presented for the developed markets. Attention is then given to emerging markets in order to provide a background with which to compare the results obtained in this study.

Chapter 3 provides information on the markets situated in the region of Central and Eastern Europe. First, the different definitions of an emerging stock markets are reviewed and then the CEE markets are examined to see whether or not they correspond to the definitions. Economic performance indicators are presented in

Chapter 3 to determine how the countries analysed in this dissertation have performed in recent years. The attractions of and obstacles to investing in emerging stock markets are then reviewed to examine whether or not it is beneficial to invest in the CEE markets.

Chapter 4 outlines the data used in the study. Descriptive statistics are calculated for the nine sample countries to provide an overall view of the data. Also, the trading method that is employed is also presented in this chapter to help the reader understand the assumptions underlying the filter and moving average rules. The remainder of the chapter presents the results of the empirical work. It should also be noted that transaction cost data are calculated and integrated into the analysis. Although they are estimations, it is important that the costs are included in order to present a realistic analysis of trading rule profitability. Furthermore, such an analysis allows various conclusions to be drawn from the profitability of trading rules in a costly trading environment. In Chapter 5, the results from the bootstrapping method are presented. The main focus of the chapter is whether the profitable rules are statistically significantly profitable. A brief literature review is included in the chapter to show what previous methods have been used. After the review, the current method of bootstrapping is explained to show how the current method differs from the other studies. The bootstrapped results are then presented to help determine if the profits are statistically significant.

Finally, Chapter 6 summarises the main conclusions that have emerged from the empirical work contained in the current dissertation, and the limitations of the study are also discussed. Finally, areas for future research are suggested.

Chapter Two

Review of the Literature

2.1 Introduction

The purpose of capital markets is to enable the efficient transfer of funds between lenders and borrowers. Individuals or firms may have access to productive investment opportunities with anticipated rates of return that exceed the market borrowing rate but not enough funds to take advantage of these opportunities. As long as capital markets exist, these entities will be able to obtain the required funds from investors, provided that the latter have confidence in a pricing mechanism that allows them to identify the most productive uses of their capital (Copeland et al., 2005). The term *efficiency* is generally used to describe the extent to which capital markets provide this assurance.

More formally, there are three different types of market efficiency commonly identified in the literature: allocational efficiency; operational efficiency; and informational (pricing) efficiency (Pike and Neale, 2003). A market is said to be allocationally efficient if prices are determined in a way that equates the marginal rates of return for all producers and savers. In an allocationally efficient market, scarce savings are optimally allocated to investments in a way that benefits everyone. Operational efficiency deals with the costs of transferring funds. In a theoretically perfect[1] market, transaction costs are assumed to be zero and markets are perfectly liquid (Copeland et al., 2005); in practice, the lower the transaction costs, the greater the extent to which any given market is efficient in an "operational" service. Finally, informational efficiency occurs if the market values of securities are fair and all information is impounded into prices in a rapid and unbiased fashion (Hill, 1998). A specific perspective regarding the extent to which capital markets are informationally

[1] The following conditions are considered necessary for perfect capital markets: (i) markets are frictionless with no transaction costs or taxes; (ii) all assets are perfectly divisible, marketable and there are no constraining regulations; (iii) all participants are price – takers; and (iv) information is costless and received simultaneously by all individuals (Copeland el al., 2005).

efficient forms the basis of the Efficient Market Hypothesis (EMH) and it is this notion of efficiency that is the focus of the present study.

The remainder of the chapter is organised as follows: Section 2.2 explains the concept of an efficient capital market and outlines the three different levels of pricing efficiency identified in the literature; the concept of the random walk model is also introduced. In Section 2.3, a summary of the ways in which random walks and weak form efficiency have been tested over the years is specified, while in Section 2.4, the review of the empirical literature that have tested weak form efficiency begins with a focus on statistical studies of weak form efficiency in developed markets. In Section 2.5, the usage of trading rules in developed markets is examined. In Section 2.6, the focus is placed on statistical studies in Emerging Stock Markets before Section 2.7 outlines evidence on the potential profitability of trading rules in Emerging Stock Markets. Finally, Section 2.8 offers a number of concluding observations regarding the prior literature and emphasises the points most relevant to the present study.

2.2 The Efficient Market Hypothesis (EMH)

According to the EMH, if new value – relevant information arises about a firm it will be incorporated into the share price rapidly and rationally with respect to the direction and magnitude of the movement (Arnold, 2002). Fama (1970) operationalised the notion of capital market efficiency by identifying three different levels of market efficiency: weak form efficiency, semi – strong form efficiency and strong form efficiency. This classificatory system has come to be widely accepted in the literature.

The notion of weak form efficiency implies that share prices fully reflect all information contained in past price movements, meaning that investors cannot earn

excess returns on a consistent basis by studying past price changes or returns. The second type of efficiency identified by Fama is semi – strong form efficiency. This form of the EMH asserts that share prices fully reflect all relevant, publicly disclosed information about the company and its circumstances. If this form of the EMH holds, it would not be possible for investors to identify mispriced securities by trading on the basis of this information set. For example, investors would not be able to consistently earn excess returns by identifying mispriced securities through an examination of annual reports or other published data because market prices would have adjusted instantaneously to any good or bad news contained in such reports.

The final type of market efficiency identified by Fama is strong form efficiency. A market is described as being strong form efficient if share prices fully reflect all public and private information. If this form of efficiency holds, "inside" investors would not be able to profit by virtue of their privileged positions[2]. It is important to note that the three levels of efficiency are not independent of one another. For example, if a market is semi – strong efficient, it must also be efficient in the weak form. Similarly, if a market is strong form efficient, it must also be weak form and semi – strong form efficient.

The weak form of the EMH is the most relevant type of efficiency for this dissertation. Underpinning this form is the notion of a fair game in equity pricing. According to the fair game model, if relevant information for assessing a company's prospects is widely and cheaply available, then it will be immediately impounded into share prices, which will continuously reflect the fundamental worth of the security. In

[2] Tests of strong form efficiency have generally focused on informed trading by insiders (Manne, 1966; Demsetz, 1969; Jaffe, 1974; Finnerty, 1976; Pope et al., 1990; Meulbroek, 1992; Gregory et al., 1994, 1997; Holland, 1998; Hillier and Marshall, 2002; Burton et al., 2003; Ryan, 2005). Testing strong form efficiency is naturally very difficult given the nature of private information and insider trading. For example, there are legal consequences for insider dealers and corporate executives if they disclose

such a market all participants compete against each other on an equal basis as no systematic differences exist between the actual return on the game (i.e. the trading of securities) and the expected return before the game is played (Pike and Neale, 2003). Mathematically, the "fair game" model is expressed as:

$$R_{i,t+1} = E(R_{i,t+1}) + \varepsilon_{i,t+1} \quad [2.1]$$

where $R_{i,t+1}$ is the actual return on security i in period $t + 1$; $E(R_{i,t+1})$ is the expected return on security i in period $t + 1$; and $\varepsilon_{i,t+1}$ is the random prediction error over the same period. The unpredictable nature of the error term means that the best estimate of the return on a security tomorrow is the return today. Therefore:

$$E(R_{i,t+1}) = R_{it} \quad [2.2]$$

Substituting [2.2] into [2.1]:

$$R_{i,t+1} = R_{it} + \varepsilon_{i,t+1} \quad [2.3]$$

Equation [2.3] is usually termed the random walk model. The random walk model states that share prices at any one time cannot be predicted because news arrives at the market in a random fashion. Therefore, successive price changes will be independent, and prices will follow a random walk as the next piece of news is independent of the last piece of news (Praetz, 1973; Arnold, 2002).

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that they have used private information in their own share dealings or have knowingly misrepresented the value of the company (Hutchinson, 1995).

Most of the theory underpinning the notion of random walks can be traced back to Bachelier (1900)[3]. However, it was not until the analysis of Mandelbrot (1963) and Samuelson (1965) that the role of the fair game expected return model and the relationship between this model and the random walk notion was established. In particular, Samuelson (1965) examined historical samples of percentage changes in share prices to show that their expected percentage movements represented a "driftless random walk." Samuelson suggested that share prices move randomly only when certain conditions are satisfied: (1) there are no transaction costs; (2) all available information is costless; and (3) all investors have similar views about the implications of the information available for current prices and for the distribution of future prices.

2.3 Empirical Evidence on Weak Form Efficiency

The notion of random walks and weak form efficiency has received a large amount of attention in the academic literature over the years. The theory of random walks has evolved to cast serious doubt on other methods commonly used for describing and predicting share price behaviour, including some that are popular outside the academic world such as technical analysis and "Chartism". The main focus of empirical studies which have examined the random walk model has been to test: (i) whether successive prices changes are independent; and (ii) whether there are trends in the sign of price changes (Fama, 1995). More recently, studies have used the more sophisticated variance ratio test developed by Lo and MacKinlay (1988) to examine the validity of the random walk.

[3] Bachelier (1900) was one of the first to develop models resembling price behaviour in the security

2.4 Statistical Studies in Developed Markets

More than five decades passed before academic publications investigating the statistical nature of share price changes began appearing in the literature. Central to many of these studies was correlation analysis. The serial correlation coefficient provides a measure of the relationship between the value of the random variable at time *t* and its value T periods earlier; if the serial correlation coefficient is close to zero, this implies that the series in question has no pattern[4], supporting the notion of a random walk.

Using weekly observations for 19 UK industrial share prices, two wheat indices in Chicago and monthly observations for cotton in New York over the periods 1928 – 1950, Kendall (1953) examined serial correlation coefficients in order to determine whether it was possible to predict future price movements. His results indicated that none of the correlations were significantly different from zero and the data behaved like a random series. Cootner (1962) arrived at a similar conclusion when he examined weekly data relating to a sample of 45 stocks listed on the New York Stock Exchange (NYSE) over 1956 – 1960. The author found that the correlations between successive price changes were generally small, although some were significantly different from zero. Overall, even though there were some digressions from random behaviour, Cootner's evidence broadly supported the notion of the random walk in share price movements.

A later study by Fama (1965) focused on serial correlation coefficients to investigate the price behaviour of the 30 securities that made up the Dow Jones Industrial Average (DJIA) index over the time period 1957 – 1962. The results

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market; one of the models developed was the random walk model. However, his work did not receive much attention from the academic community for many years.

[4] Working (1934) examined US security prices and found that the time series represented a random difference series. This type of series has properties that are very similar to the random walk model.

indicated that all the sample serial correlation coefficients were quite small and not significantly different from zero; in fact, the largest first order serial correlation coefficient was only 0.123. In addition, when looking at a one–day lag, although 22 out of the 30 correlations were positive, only 11 of the coefficients were significantly larger than expected. Correlations over different lag lengths (4, 9 and 16 days) were also quite small. Overall, Fama concluded that the dependence in price changes was very small or non – existent, with strong evidence in favour of the random walk model.

Similarly, Dryden (1970a) was forced to conclude, on the basis of a serial correlation analysis, that there was no evidence to refute the random walk hypothesis for the UK stock market. In particular, using the daily closing prices of 15 securities over 1963 – 1967; Dryden found that most of the correlations for 1 – 12 lag lengths were small and statistically insignificant. Those coefficients that were significant were mainly in the 1- and 2-day lags[5]. Those lags that were greater than 1 day exhibited no clear pattern in sign. However, Brown and Easton (1989) studied 10,227 daily UK share price changes over the much earlier period 1821 – 1860, and found that the serial correlation at lag 1 was statistically significant at 0.0049. In addition, 7 out of the 23 higher – order serial correlations were significant, and 5 out of the top 8 were significant, although the value was only 0.133. Overall though, the authors' conclusion was that even in the nineteenth century, patterns in share price changes were insubstantial.

A more recent paper by Solnik (1973) built on the early literature by examining the validity of the random walk hypothesis for eight major European stock markets (Belgium, France, Germany, Italy, The Netherlands, Sweden, Switzerland

[5] The value of 0.2362 recorded for the 1 day lag was the largest for the entire series.

and the UK). In particular, using data for 234 securities over the period March 1966 – April 1971, Solnik examined the distribution of serial correlation coefficients for daily, weekly, bi-weekly and monthly returns. Solnik's results showed that the serial correlation coefficients were very small and generally not significantly different from zero; as the time interval increased the departure from the random walk became even less pronounced. However, on further investigation, Solnik found evidence of a measure of stability in that if a share showed positive or negative serial correlation in one period, this tended to persist into the next period; for example, the correlation between the daily (bi – weekly) returns for Switzerland was 0.36 (0.38). This was not the case for the UK market, however, where the correlation for the daily (bi – weekly) return was found to be 0.14 (0)[6]. Overall, Solnik concluded that the European markets examined exhibited some departure from the random walk hypothesis.

Batten and Ellis (1996) investigated the Australian All Ordinaries Share Price Index over the period April 1987 – December 1991 using weekly data. Serial correlation tests showed that the highest figure was 0.32313 (for lag 1), whereas lags 3 and 5 provided negative results of -0.00289 and -0.08076, which were significant at the 1 per cent level. In general, however, the authors' conclusion was that the market was weak form efficient during the timeframe studied.

Elton et al. (2003) summarised international evidence regarding average correlation coefficients in share returns. The study documents correlations for Australia (Praetz, 1972), Greece (Niarchos, 1971), Norway (Jennergren, 1975), Sweden (Jennergren and Korsvold, 1975), the UK (Kendall, 1953; Alexander, 1961; Griffiths, 1970) and the US (Moore, 1962; King, 1966; Cootner, 1974; Fama, 1988). The samples studied varied in size from 5 to 63 companies and the time intervals

[6] In contrast, Al – Loughani and Chappell (1997) found that the FTSE 30 index did not follow a

ranged from 1 day to 16 weeks. The results indicated that the correlation coefficients were generally very low; the highest correlation was 0.156, implying that only 2.43 per cent of the variation in return on day *t* was explained by the returns on day *t – 1*.

Although the majority of early studies in the area use serial correlation coefficients to derive conclusions about the extent of weak form market efficiency, the evidence tends to be influenced by extreme observations, indicating that the results could be due to a few unusual observations. In addition, serial correlation tests are unable to detect non – linear patterns in the data. An alternative approach for examining independence is to analyse the runs in the series of share prices. In this type of analysis, the signs of successive prices changes are examined, with a run being defined as a sequence of price changes of the same sign (Roberts, 1959). Therefore, if price changes are positively related, then price increases (decreases) will tend to be followed by further increases (decreases) in price. According to this notion, if the actual number of runs exceeds the expected number of runs, the series is not random.

In addition to the serial correlation coefficients tests outlined earlier, Fama (1965) also performed a runs test. The actual number of runs was compared to the expected number of runs over the 1, 4, 9 and 16–day intervals. For the 1–day interval, the actual number of runs was less than the expected number (735.1 v 759.8). However, as the time intervals increased in length, the actual numbers of runs approached the expected number. For example, the 16–day interval averages were 41.7 for the expected number and 41.6 for the actual. Therefore, Fama concluded that there were no grounds to reject the random walk hypothesis.

A similar conclusion was arrived at by Dryden (1970a) who also performed a runs analysis in addition to a test of serial correlations. Using 15 UK securities, he

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random walk over the period 1983 – 1987; the study employed the Lagrange Multiplier to test serial

found that the differences between the actual and expected number of runs were quite small. These results are supported, even for nineteenth century data, by Brown and Easton (1989) who found that, the actual number of runs was within 4 per cent of the expected number. In most cases on the basis of these results, they concluded that the UK market exhibited a degree of weak form efficiency.

A more sophisticated test of the random walk hypothesis was developed by Lo and Mackinlay (1988). Specifically, a "variance ratio" is computed by dividing the variance of returns for the longer intervals by the variance of returns for the shorter intervals. If the ratio is greater than 1, it suggests that the series is positively correlated and if it is less than 1, then the series is considered to be negatively correlated. A value of 1 for the ratio indicates that the series follows a random walk. Lo and Mackinlay (1988) tested the random walk hypothesis using weekly returns for the US market over the period 1962 – 1985[7]. Using the variance ratio to test for lags of 2, 4, 8 and 16 weeks, they found that the random walk hypothesis was rejected at the 5 per cent level of significance[8]. The overall conclusion was that the US stock market does not follow a random walk.

2.5 Trading Rules in Developed Markets

An alternative approach to testing the weak form of the EMH involves examining the profitability of technical trading rules. Trading rules are active investment strategies which are designed to exploit trends in share prices movements.

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independence.

[7] Seiler and Rom (1997) investigated the random walk notion using daily stock prices from the New York Stock Exchange (NYSE) over the period 1885 – 1962 using the Box – Jenkins technique. They found that the changes in stock prices were completely random.

Indications that trading rules are profitable would therefore constitute evidence against the weak form of the EMH. The filter rule implies the following trading strategy:

> "If the daily closing price of a particular security moves up at least x per cent, buy and hold the security until its price moves down at least x per cent from a subsequent high, at which time simultaneously sell and go short" (Fama and Blume, 1966, pp 227 – 228).

The logic behind the filter rule is that there are non – linear trends in share prices which can be exploited by buying at the start of an upward trend and selling the share at the beginning of a downward trend. An example of the filter rule is provided by Dryden (1970a);

> "….if a share is bought at 100 and moves on the next day to 110 then a 5 per cent filter would trigger a sell decision if the next day's price is less than (or equal to) 104.5 (that is, 110 minus 5 per cent of 110)…If, in the above example, the price fell on the second day to 96, that is by 4 per cent, then a 5 per cent filter rule would not initiate a sell decision." (pp 379).

Using daily closing price data for the Dow Jones Industrial Average and the Standard and Poors Index between the time periods 1897 – 1929 and 1929 – 1959, Alexander (1961) investigated the profitability of 11 filters ranging in size from 5 to 50 per cent. He argued that if share price movements are random, the filters would be expected to yield zero profits. The results showed that over the 1929 – 1959 period, smaller filters, (such as the 5, 6 and 8 per cent rules) generated larger returns (36.8, 30.0 and 24.5 per cent, respectively) than those recorded by the corresponding buy – and – hold strategy[9] (3 per cent). On the basis of these results, Alexander concluded

[8] However, positive correlations were found for weekly holding periods.
[9] The buy-and-hold strategy outperformed the filters by more than eight per cent over the period 1914 – 1929.

that there were exploitable trends in the data and, as such, there was no support for the random walk model. However, Mandelbrot (1963) was critical of Alexander's methods, claiming that he overstated the profitability of the filter rules. Indeed, Mandelbrot queried the price at which the average trader could buy at in relation to the filter.

Alexander responded to Mandelbrot's criticism by revising his original analysis to take account of the potential bias by using closing price data; this study was published in 1964. The bias arose from Alexander's assumption that the rational trader could buy at the low price plus the filter and sell at the high price minus the filter; the price differences would then give incorrect results. The daily data for the Standard and Poors Index was examined over the period 1928 – 1961. Only the 45.6 per cent filter (generating a return of 9.2 per cent) now outperformed the buy – and – hold strategy (5.1 per cent). All of the other filter rules underperformed the buy – and – hold strategy. Before transactions costs, very small filter such as 1.0 per cent also proved profitable, but on a net basis, the filter underperformed, indicating that trading costs seriously eroded trading rule profitability.

Further evidence regarding the filter rules was provided by Fama and Blume (1966), who employed Alexander's filter technique to study daily data for 30 individual shares from the Dow – Jones Industrial Average[10] over the period 1956 – 1962. In particular, they examined the performance of 24 different filter rules ranging in size from 0.5 to 50 per cent, with all the returns being adjusted for dividends and transaction costs. The results showed that only 6 (12, 14, 16, 18, 20 and 25 per cent) out of the 30 filters yielded positive average returns after commission costs. On excluding the costs, the smallest filters (0.5, 1 and 1.5 per cent) earned the highest

positive returns of 20.89, 14.44 and 11.43 per cent respectively for the long position as compared to only 9.86 per cent for the buy-and-hold strategy. However, the results showed that the smallest filter generated 12,514 trading signals which would substantially erode the profitability of the strategy. Overall, Fama and Blume concluded that the average investor would not have been able to consistently earn returns higher than a buy – and – hold strategy once trading costs were deducted[11].

In a later analysis, Sweeney (1988) re – examined the results of the Fama and Blume (1966) study, but introduced some important modifications. Sweeney suggested that of the sample of 30 DJIA shares, half could be regarded as "winners". Specifically, shares were classified as "winners" if they performed significantly well in subsequent periods[12]. Sweeney also restricted the trading strategy to include long equity positions only; short positions were omitted from the study as they performed poorly and greatly increased the cost of the trading strategy. The results showed that the filter rule provided excess returns after transaction costs; a statistically significant excess return of 14.67 per cent was recorded when transaction costs were set at 0.05 of 1 per cent, while a 10.28 per cent return was generated when transaction costs were set at 0.10 of 1 per cent.

Sweeney (1990) performed a follow – up analysis and gave an example of a short term technical strategy that produced statistically significant risk – adjusted profits after transaction costs. Using daily returns data for the period 1970 – 1982, the strategy involved using a filter program to identify the top 50 "winner" shares (out of a total of 293) for the 1972 trading period. The results showed that the average profit

[10] Fama and Blume (1966) argued that, due to the use of index level data rather than individual company level data, Alexander took no account of dividends and that this, therefore, biased the filter results upwards.

[11] Even floor traders (who pay lower transaction costs) would not be able to take advantage of the filters.

would have been 26.5 per cent for a floor trader incurring trading costs of 0.05 of 1.0 per cent, while a trader would have made 14.3 per cent with a trading cost of 0.20 of 1 per cent. This led Sweeney to conclude that a short – term trading strategy could only work with low transaction costs and small filters.

While many of the earlier studies of filter rule profitability focused on the US market, Dryden (1970a) used the filter rule (in addition to computing serial correlation coefficients and performing a runs analysis), to examine weak form efficiency for the UK market. This study investigated the daily prices of 15 UK securities over the 1963 – 1964 and 1966 – 1967 periods using 14 filters ranging in size from 0.2 to 6 per cent. Dryden found that, when the rates of return were averaged over all the filters[13], the long positions were positive and the short positions were mainly negative. In addition, the study reports that the individual buy – and – hold returns were rarely negative, with the average never becoming negative. Specifically, the average return for the buy – and – hold strategy was 11.1 per cent as compared to the average return for the filter rule of only 0.7 per cent. Moreover, on comparing the filter rule to the buy – and – hold strategy, Dryden found that the naïve strategy outperformed the filter rule in the majority of cases[14]. In general, the filter rates of return declined rapidly with increasing filter size.

However, in a later study examining 12 filters ranging in size from 0.1 to 5 per cent[15], Dryden (1970b) arrived at a different conclusion. When using all three data sets, the filter rates of return tended to decrease as filter size rose, with the rates of return for filters larger than 2.5 per cent fluctuating in an erratic fashion. The smallest

[12] This concept of a share performing well in one period and continuing to do well in the next period is consistent with the winner – loser effect identified by DeBondt and Thaler (1985, 1987).
[13] Only the filters sizes ranging from 0.2 to 0.4 per cent were used, as on investigation of the second period (1966 – 1967), larger filters failed to initiate any transactions.
[14] With the exception of the first 2 smallest filters (0.2 and 0.6 per cent)
[15] Filters over 5 per cent were not considered as there were few trigger points.

filter of 0.1 per cent was the most profitable, with the rule based profits, both long and short, exceeding those from the buy – and – hold strategy. The overall conclusion from the study was, therefore, that the UK stock market did not follow a random walk.

Praetz et al. (1975) tested the profitability of the filter procedure for the Australian stock market, applying 10 filters to the price data of companies listed on the Melbourne stock exchange over the period 1958 – 1966. The results showed that before transaction costs the long positions were all positive and the short positions were all negative. After transaction costs, most of the long positions had turned mainly negative. Overall, the buy and hold return of 9.5 per cent exceeded the -15.3 per cent return of the filter rule and so the authors concluded that there was no evidence to reject the weak form of the efficient market hypothesis for the Australian Stock Market.

A later study by Emanuel (1980) examined the efficiency of the New Zealand Stock Exchange using the filter strategy for 70 companies over the period 1967 – 1976. Seven filters, ranging in size from 0.5 to 32 per cent, were tested and the results showed that the long positions were positive and the short positions were negative. In addition (with the exception of the two smallest filters of 0.5 and 1 per cent) as the filter size increased, the trading rule profit decreased; when the filters were greater than 2 per cent in size, the control portfolio consistently outperformed the filter rule. For example, using the 8 per cent filter, the profit was 0.1 per cent while the control portfolio generated a return of 0.2 per cent. Emanuel concluded that the filter rules during the period examined were not profitable, thereby indicating support for the weak form of the EMH.

Another trading rule that has proved popular among investment practitioners is the moving average rule. The moving average rule is used to help investors to smooth out small fluctuations in the share price and, in turn, identify any long term trends. The moving average rule is also used by technical analysts who initiate buy and sell decisions after comparing the short-run moving average of the share price with its long-run moving counterpart. Normally, these rules are identified via "short, long, band" notation where short and long are the length of periods spanned in the short – run and long –run moving averages respectively, and band is the percentage difference that is needed to generate a signal (Gunasekarage and Power, 2001). Two popular types of moving average rule have been tested in the literature: the variable – length moving average rule (VMA) and the fixed – length moving average rule (FMA). The difference between these two rules is that the FMA has a holding period of 10 days.

An early application of this approach was described in by Van Horne and Parker (1967) who investigated three different moving average rules with five different thresholds over the period January 1960 – June 1966 using daily share price data for 30 shares listed on the New York Stock Exchange. The moving averages were for 100, 150 and 200 days and the thresholds tested in each case were 0, 2, 5, 10 and 15 per cent[16]. The authors tested 2 different strategies: (i) where long positions only are allowed; and (ii) with both short and long positions. None of the rules proved to be profitable when compared to the buy – and – hold strategy after the consideration of transaction costs. A similar conclusion was reached by James (1968) who performed a series of experiments on month – end share prices over the period 1926 – 1960 using different moving average lengths.

Although early evidence on both filter and moving average rule indicates that they are unlikely to outperform a corresponding naïve trading strategy, some promising evidence has emerged more recently. For example, Brock et al. (1992), who investigated the performance of the moving average rule and the trading range break – out (TRB) rule[17] using daily data for the Dow Jones Industrial Average over the period from the first trading day in 1897 to the last trading day in 1986. The time period therefore consisted of 90 years of daily data and this was then split into 4 sub – periods[18]. Five different variations of the moving average rule were tested: 1 – 50, 1 – 150, 5 – 150, 1 – 200 and 2 – 200, and a band of 0 and 1 per cent was also introduced around the moving average length in order to eliminate "whiplash" signals[19]. All the trading rules used had a holding period of 10 days and transaction costs were ignored.

The results for the VMA rules were striking as the buy returns were all positive, with an average one-day return of 0.042 per cent as compared to an unconditional daily return for the buy – and – hold strategy of only 0.017 percent. Furthermore, the result was statistically significant for 6 of the 10 strategies examined. The sell return recorded an average daily return of -0.025 per cent and all 10 strategies yielded significant results. The results were similar across the different sub – periods. For the FMA rules, the average buy returns of 0.53 per cent far exceeded the unconditional mean return of 0.017 per cent. All the sell returns were

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[16] The rules examined were represented as (1, 100, 0), (1, 150, 0), (1, 200, 0), (2, 100, 2), (2, 150, 2), (2, 200, 2), (1, 100, 5), (1, 150, 5), (1, 200, 5), (1, 100, 10), (1, 150, 10), (1, 200, 10), (1, 100, 15), (1, 150, 15) and (1, 200, 15).

[17] For the trading range break – out rule (TRB), a buy (sell) signal is generated when the price penetrates the resistance (support) level at the maximum (minimum) price. The maximum or minimum prices were determined on the past 50, 150 and 200 days.

[18] The sub periods were 1 / 1 / 1897 – 30 / 7 / 1914, 1 / 1 / 15 – 31 / 12 / 1938, 1 / 1 / 1939 – 30 / 6 / 1962 and 1 / 7 / 1962 – 31 / 12 / 1986. These periods were chosen as the first sample period ends with the closing of the stock exchange during World War I. The second sample includes a rising period in the twenties and a time of depression. The third sample includes the period of World War II and ends in June 1962. The final period uses data from the CRSP which it was established in 1962.

[19] The 10 rules tested were, therefore, (1, 50, 0), (1, 50, 0.01), (1, 150, 0), (1, 150, 0.01), (5, 150, 0), (5, 150, 0.01), (1, 200, 0), (1, 200, 0.01), (2, 200, 0) and (2, 200, 0.01).

negative and below the unconditional mean return, with the average sell return equalling 0.150 per cent[20]. Brock et al. (1992) concluded that it was possible for technical trading rules to pick up some patterns in the data, also the extent was dependent on the precise form adopted.

Hudson et al. (1996) replicated the Brock et al. (1992) study using data for the UK stock market. The study examined daily share prices for the Financial Times Industrial Ordinary Index from July 1935 – January 1994, split into 3 sub – periods: 1931 – 1951 (to reflect the World War years); 1951 – 1966 (to cover the post war years); and 1966 – 1981 (to reflect a period of underlying political and economic uncertainty). The moving average rules examined were the same 10 employed by Brock et al. (1992). For the VMA rules, the buy returns were all positive with a 1–day average of 0.058 per cent. Only 2 out of the 5 strategies were significant at the 5 per cent level however, whereas for the sell returns 4 out of the 5 rules yielded significant results. The sell returns were negative with an average 1–day return of -0.021 per cent while the average buy – and – hold return value was 0.0786 per cent. On investigating the sub – periods, the buy and sell returns were still positive and negative respectively but were only significant in the first 2 sub – periods (1935 – 1951 and 1951 – 1966); the results generally lose significance as the sub – periods become more recent.

For the FMA rules, the 1–day average return for the buys was 0.99 per cent while the sell signals generated -0.63 per cent. These returns compared to the average 10–day holding period return of 0.26 per cent. The average buy – and – hold return value for the FMA was 1.63 per cent. For the buys, only 3 strategies were significant

[20] For the trading range break – out rule, the buy returns were all positive and earned an average return of 0.55 per cent. The sell returns were negative and recorded an average return of -0.24 per cent.

at the 5 per cent level and, for the sells, all were significantly negative[21]. On studying the sub – periods, less than half of the strategies yielded significant returns at the 5 per cent level. One important difference between Hudson et al. (1996) and Brock et al. (1992) is that the former study examined trading rule profitability in a costly trading environment, concluding that in the presence of trading costs, the trading rules were unlikely to outperform the buy – and – hold strategy.

Another trading strategy that has been used to test market efficiency in the literature is the relative strength rule. This rule measures the price trend of a share relative to how others in the industry are performing. Levy (1967a, b) examined the strategy using weekly data for a sample of 200 shares listed on the New York Stock Exchange over the time period 1960 – 1965. In Levy (1967a), the relative strength of each share was calculated and ranked on a week – by – week basis. If the relative strength is a valid criterion for investment selection, then an investment strategy of portfolio upgrading should prove to be successful. Levy found that all the gross annual returns exceeded the geometric average, thus providing evidence that technical analysis produced a greater profit at lower risk over the period considered. In a follow – up study, Levy (1967b) found that relative strength tends to persist over longer periods (26 weeks), although this was not the case for shorter periods (4 weeks). Therefore, shares that had been relatively strong and volatile in the past tended to produce higher profits moving forward.

Jensen and Benington (1970) replicated Levy's studies using monthly data for a sample of shares quoted on the New York Stock Exchange over the period January 1926 – March 1966. The authors divided the 40 year sample period into 7 non – overlapping time periods which were equal in length to those examined by Levy. The

[21] For the TRB rule, the average return over the 10 days following a buy signal was 0.7 per cent and for

results showed that, before transaction costs, the trading rules earned approximately 1.4 per cent more than the buy – and – hold policy. However, after transaction costs, the buy – and – hold strategy outperformed the trading rule in the majority of cases.

2.6 Statistical Studies in Emerging Stock Markets

In recent years, as emerging stock markets have captured investors' attention, issues relating to emerging financial market behaviour have moved up the research agenda. Indeed, a proliferation of studies have investigated the efficiency of these markets. As with the literature on developed markets, the approaches to testing the extent of emerging market efficiency can all be placed in one of two broad groups: (i) statistical studies which utilise simple techniques such as serial correlations (and runs test and the more advanced variance ratio tests); as well as (ii) studies which have focused on the predictive ability of trading rules.

In terms of statistical tests, one of the most comprehensive studies to date was performed by Claessens (1995) who employed serial correlation coefficients to analyse the predictability of share prices on emerging stock markets (ESMs) using economy indices and size – based portfolios. In total, 20 (Argentina, Brazil, Chile, Colombia, Greece, India, Indonesia, Jordan, Republic of Korea, Malaysia, Mexico, Nigeria, Pakistan, the Philippines, Portugal, Taiwan, Thailand, Turkey, Venezuela and Zimbabwe) ESMs were utilised in this study over the period 1976 – 1992[22] using monthly data. On analysing the economy indices, the first order autocorrelations for 9 economies out of the 20, proved to be significant at the 5 per cent level. In addition, 7 of those economies had a serial correlation higher than 0.2. In contrast, the seven

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the sell signal -0.43 per cent.

[22] However, some emerging market start dates were different such as Jordan which started in 1979; Colombia, Malaysia, Nigeria, Pakistan, the Philippines, Taiwan and Venezuela started in 1985. Portugal commenced in 1986, while Turkey began in 1987 and Indonesia started in 1990.

developed markets[23] investigated all had serial correlations below 0.2. Of the size – based portfolios, 26 out of 75 exhibited significant correlations, but there was no significant pattern across the portfolios. The authors conclude that there was a relatively high degree of predictability at the time of the study, with the emerging markets not representing a "level playing field".

An analysis of autocorrelations was used by Poshakwale (1996) to examine the behaviour of daily equity prices on the Bombay Stock Exchange over the period January 1987 – October 1994, using lags of 1 – 20 days. The results indicate the presence of significant autocorrelations at the 1st, 4th, 9th, 10th, 14th and 15th lag, suggesting that there is serial dependence between the values, and thus indicating a violation of weak form efficiency.

More recently, Mobarek and Keasey (2002) examined daily price changes on the Dhaka Stock Exchange over the time period 1988 – 1997, and report that the Bangladeshi market is not weak form efficient. On performing an autocorrelation test over lags 1 – 22, significant positive correlations at four different lags (5th, 8th, 14th and 19th) were discovered and two significant negative lags (2nd and 17th) for the whole sample period. The presence of non – zero correlation coefficients clearly suggests there was serial dependence in price changes.

In the African region, the efficiency of the Johannesburg Stock Exchange (JSE) was investigated by Affleck-Graves and Money (1975) who studied serial correlation amongst weekly price movements for 50 shares quoted on the JSE from April 1968 – September 1973. Using lags of 1, 2, 3, 4, 5, 7, 9, 10, 15 and 20 days, the authors found that the extent of serial correlations decreased as the lags increased, with the first and second lags having the largest values. However, none of the lags

[23] Canada, France, Germany, Japan, Switzerland, the UK and the US represented the developed

had autocorrelations that were significantly different from 0, and the conclusion in the study was therefore that the empirical tests indicated support for the random walk model[24].

The emerging markets of Central and Eastern Europe have also been studied in this manner. For example, Abrosimova et al. (2002) examined daily, weekly and monthly data for the Russian Trading System index between September 1995 – May 2001 to test the null hypothesis of a random walk model. For the daily and weekly data, 30 lags were analysed, while for the monthly data 15 lags were examined. The results revealed that the correlations for the 1st, 10th, 13th and 30th lags for the daily data and the 2nd lag for the weekly data were significantly different from 0, thus rejecting the random walk model. However, for the monthly data there were no significant results. Overall, the study concludes that no notable weak form inefficiencies exist, irrespective of whether daily, weekly or monthly data is used.

Omran and Farrar (2006) employed weekly data for five major emerging markets (Egypt, Israel, Jordan, Morocco and Turkey) to test the validity of the random walk hypothesis over the period January 1996 – April 2000. The autocorrelations estimated were for 6, 12 and 24 lags. The results indicate that Egypt and Morocco had 5 and 2 significant autocorrelation coefficients respectively at all lags, thereby contradicting the random walk hypothesis[25] for these markets.

Runs tests have also been employed widely in emerging markets. An early example is a study by Fawson et al. (1996) who investigated weak form efficiency in the Taiwan Stock Market using a number of techniques, including a runs test, with monthly data over the 27 – year period, January 1967 – December 1993. On

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markets in this study.

[24] Similar results were obtained for Frankfurt, London and New York.

[25] No significant correlations were found for Jordanian and Israeli markets. However, Turkey had 1 significant coefficient at lag 24, implying that the time series may not be completely random.

performing the runs test, the coefficient was found to be negative, indicating that the actual number of runs was less than the expected number, and that the series was random.

Babu and Pandian (2002) examined daily and weekly data from 6 leading Indian indices (Bombay Stock Exchange, Bombay Stock Exchange Sensex, CRISIL NSE 500, CRISIL NSE Defty, CRISIL NSE Nifty and CRISIL NSE Nifty Junior) over the period March 1995 – January 2001. The runs test results suggested that the indices are weak form efficient, but the autocorrelation statistics indicated that the share prices do not conform to the random walk model (consistent with Poshakwale's evidence cited earlier). These conflicting results point to the need for employment of a range of tests when examining the empirical validity of this category of the EMH.

To complement their analysis of autocorrelation on the Dhaka Exchange, Mobarek and Keasey (2002) also investigated patterns in runs over 3–30 day intervals. The number of runs was greater than 20 in all cases, but the figure was consistently less than the expected number, the results indicate non – compliance with the random walk on the Dhaka Stock Exchange support the findings of their autocorrelation analysis discussed earlier.

Squalli (2006) studied daily data for two Middle Eastern markets, the Dubai Financial Market and the Abu Dhabi Securities Market, between September 1991 – July 2005 and March 2000 – September 2005 respectively. The author found that the actual number of runs was substantially lower than the expected number for all the sectors in both markets thereby suggesting that neither follows the characteristics of a weak form efficient structure in equity pricing. In addition to the autocorrelation test for five Middle Eastern markets reported earlier, Omran and Farrar (2006) also performed a run test analysis. The study found that (as was the case for

autocorrelations) Egyptian and Moroccan data rejected the random walk hypothesis at the 5 per cent level, whereas Israeli data supported the random walk hypothesis. For Jordan and Turkey, there was some evidence for rejecting the random walk hypothesis, but at the 10 per cent significance level only.

In addition to estimating the serial correlations on ESMs, the variance ratio test has been used to examine the validity of the random walk hypothesis by several authors, including Claessens (1995). On the basis of holding periods of 2 and 4 months, the null hypothesis of equality in variances was rejected for seven of the countries investigated. Specifically, the variance ratios were higher for the 4 month holding period than the 2 month holding period[26]. These results led the authors to conclude that the random walk model did not hold for their dataset. For the size – based portfolios, and a two (four) month holding period, 15 (23) of the 76 portfolios rejected the random walk hypothesis at the 5 per cent significant level. The evidence thereby mirrors the result from the serial correlation test.

In the same year, the variance ratio test was used by Huang (1995) to investigate the random walk hypothesis in eight Asian stock markets (Hong Kong, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Thailand and Taiwan[27]). Weekly stock returns were gathered for the period January 1988 – June 1992 and holding periods of 4, 6, 8, 10, 20, 30 and 40 weeks were examined. The null hypothesis of the random walk was rejected for all the holding periods in Korea and Malaysia markets, as well as in weeks 8 and 10 for the Philippines market and week 40 for Hong Kong. For the other markets, the null hypothesis could not be rejected.

[26] A similar result was obtained for longer holding periods.
[27] Chang and Ting (2000) employed the variance ratio test for weekly, monthly, quarterly and yearly data relating to the Taiwanese stock market over the period January 1971 – January 1996. The results showed that the random walk could be rejected for this market.

Islam and Khaled (2005) examined weak from efficiency on the Dhaka Stock Exchange via application of the variance ratio technique to daily, weekly and monthly data. The daily data covered the period January 1990 – November 2001; the weekly and monthly data covered the periods up to November 2001 and October 2001 respectively. The lags investigated were 2, 4, 8, 16, 32, 64 and 128 days. The results indicated that weak form efficiency could not be rejected for the weekly and monthly data at lags 2 – 64 and 2 – 32 respectively at the 5 per cent significance level. For the daily data, only at lag 2 was the value significant, and this was due to an error in autocorrelation. The authors were therefore forced to conclude that the Dhaka Stock Market was weak form efficient.

Latin American markets were the focus of Ojah and Karemera (1999) who investigated the validity of the random walk model using the variance ratio in Argentina, Brazil, Chile and Mexico. Monthly data over the period 1987 – 1997 was collected and 2, 4, 8 and 16 month intervals investigated. After performing the variance ratio test, only the Argentinean market was formed to follow a random walk[28].

Abraham et al. (2002) employed the variance ratio test to study the random walk properties of three emerging markets in the Gulf (Bahrain, Kuwait, Saudi Arabia) over the period 1992 – 1998 using weekly data. The ratio was computed for multiples of 2, 4, 6, 8 and 16 weeks. The initial results revealed that the random walk hypothesis could be rejected for all three Gulf markets. However, when the data were corrected for thin trading, the random walk could no longer be rejected for the Bahrain and Saudi Arabia markets.

[28] Although the only significant values for Chile and Mexico were at lag 2.

The study by Abrosimova et al. (2002), referred to earlier in terms of their autocorrelation tests, also used variance ratio tests, computed for 30 lags of daily and weekly data and 15 lags for monthly data, to investigate the extent of weak form efficiency in Russia. All the coefficients were found to be significantly different from 1 for daily data and weekly data, except for the 2nd lag for the latter. For the monthly data, the variance ratios were significantly different from 1 up to and including lag 10. Overall, the study indicates that the null hypothesis of a random walk was rejected for the daily and weekly data, but not for the monthly data.

Smith and Ryoo (2003) used the variance ratio test on five European emerging markets (Greece, Hungary, Poland, Portugal and Turkey), using weekly data from April 1991 – August 1998 with 2, 4, 8 and 16 week intervals. The results indicated that Greece, Hungary, Poland and Portugal followed a similar pattern in rejecting the random walk hypothesis. The Turkish market differed notably in pricing patterns, with the tests showing that it followed a random walk. Similarly, Squalli (2006) found the random walk hypothesis could be rejected for the Abu Dhabi Securities Market and Dubai Financial Market, although the random walk was not rejected for the banking sector.

Finally, in addition to the runs test and autocorrelation analysis performed for five Middle Eastern markets described earlier, Omran and Farrar (2006) used the variance ratio as a further test of the random walk hypothesis and found that none of the Middle Eastern indices support the weak form of the EMH on this basis.

2.7 Trading Rules in Emerging Markets

As noted in Section 2.5, there have been numerous studies of the profitability of trading rules in developed countries. However, researchers now regularly use the

techniques to examine the extent of weak form efficiency in emerging economies in different geographical regions such as Asia, the Caribbean, Central and Eastern Europe, the Middle East, South America and a others markets around the world. One of the first studies of this nature was Huang (1995) who investigated weak form efficiency on the Taiwan Stock Exchange by simulating the trading performance of filter rules and comparing these to the buy and hold strategy. A total of 24 filter rules were tested in the study, ranging in size from 0.5 to 50 per cent over the daily sample period 1971 – 1993. The results showed that, before transaction costs, only the larger filters (30 and 50 per cent) were able to outperform the buy and hold strategy. However, after transaction costs only the medium sized filters (4 and 18 per cent) were able to beat the buy and hold strategy. The average performance of the 24 filters was 29.2 per cent compared to an average buy and hold strategy return of 19.3 per cent. On examining four sub – periods: 1971 – 1976; 1977 – 1981; 1982 – 1986 and 1987 – 1993, the filter rules were found to perform better than the buy and hold strategy, even though market conditions varied over the sub – periods; the same conclusion held when the 8 per cent filter was compared to the buy and hold strategy, i.e. departures from weak form efficiency were characteristics of the market.

A rare Caribbean – based study, by Hunter (1998), examined the daily prices of 26 of the most actively traded stocks listed over the six year period from January 1989 – December 1994 on the Jamaican Stock Exchange. The performance of filter rules ranging from 5 per cent to 50 per cent were compared to the naïve buy and hold strategy. The results indicated an inverse relationship between filter size and the number of triggers, with the smallest filters generally proving to be unprofitable in the presence of transaction costs. The most notable result reported in the paper, however, was that on average the buy and hold strategy outperformed all the filters, even those

which generated few transactions. This result is in direct conflict with Huang (1995) who used the same filter rules to examine Taiwanese data.

Turning to the moving average rule, Bessembinder and Chan (1995) investigated six Asian markets (Hong Kong, Japan, Korea, Malaysia[29], Thailand and Taiwan) using daily data over the time period 1975 – 1989. The trading rules scrutinised were the same as those in Brock et al., (1992) discussed above and the bootstrapping procedure used was also similar[30]. The VMA rules had the greatest forecasting power for stock markets in Malaysia, Thailand and Taiwan, where the difference in mean buy and sell returns across the 10 rules averaged 0.168 per cent per day; in contrast, for Hong Kong, Japan and Korea the difference in mean buy and sell returns averaged across the rules was only 0.037 per cent per day. These results were confirmed by the bootstrapping techniques. A similar conclusion emerged for the FMA rules; the mean returns on "buy" days exceeded mean returns on "sell" days by 0.078 per cent per day[31].

The Brock et al. (1992) methodology was also employed by Coutts and Cheug (2000), in this case to investigate daily price changes on the Hang Seng[32] index over the period 1 October 1985 – 30 June 1997 (which was then split into two sub –

[29] Lai et al. (2002) used daily data over the time period 3 January 1977 to 31 December 1999 to examine the moving average rule on the Kuala Lumpur Stock Exchange Composite Index (KLSE CI). The trading rules examined were the VMA and FMA along with the variations: (5, 60, 0), (5, 120, 0), (5, 180, 0), (5, 60, 0.01), (5, 120, 0.01) and (5, 180, 0.01). The VMA rules generated more buy than sell signals. Also, the buy signals were significantly positive and the VMA rule earned significantly higher returns than the buy and hold strategy. The FMA rules also generated more buy than sell signals and produced significantly higher returns compared to the buy and hold strategy at the 5 per cent level. Therefore, it rejected the hypothesis that the rules generated zero returns.

[30] One difference between this and the earlier study was that the former assumed that if the buy signal returns differ from the sell signals then technical analysis has predictive power.

[31] The TRB rule had a similar result of 0.145 per cent per day.

[32] This index was studied by Wong (1995) who used daily prices between the time period December 1969 – March 1990. It was divided into 5 non-overlapping sub-periods where all the bullish and bearish signals of Moving Average 10 (MA10), Moving Average (MA20) and Moving Average (MA50) were obtained. For all the bullish, MA 10, MA 20 and MA 50 the nominal and excess returns on the event date and in the post-event period have a positive sign. It supports the notion that the trend – chasing technical signals constitute important information in the market and that investors chase trends with them.

periods: 1 October 1985 – 12 August 1991 and 13 August 1991 – 30 June 1997). For the moving average rule, the analysis revealed that the number of buy signals exceeded the number of sell signals (consistent with a "bull" market), and the buy returns were all positive with a one-day average of 0.155 per cent. The sell signals were all negative with a mean of -0.152 per cent. The buy and sell signals yielded significantly positive and negative returns respectively for both sub – periods, thereby refuting Hudson et al's. (1992) contention that for the moving average rule only has predictive ability over longer periods (15 to 20 years). For the TRB rule, the result conflicted with previous studies as the buy signals outperformed the sell signals, earning an average 10–day cumulative return of 1.6 per cent (sell = -5 per cent), which was higher (lower) than the moving average rule. The overall conclusion in the study was that the moving average and TRB rules can exploit a degree of predictability (ignoring transaction costs) with the TRB rule proving to be the strongest.

Gunasekarage and Power (2001) reviewed 4 South Asian capital markets (Bangladesh, India, Sri Lanka and Pakistan) over the period January 1990 to March 2000 using daily data and 9 moving average rules[33]. For the VMA rules, the buy returns were all positive and the sell returns all negative in each market. However, the returns earned by the VMA rules were less than those achieved by following a buy and hold strategy. For the FMA rules, the majority of the average buy and sell returns were significantly higher from those achieved by the buy and hold strategy. Overall, the authors' conclude that the South Asian capital markets were not weak form efficient at the time of this study.

[33] The rules employed were (1, 50, 0), (1, 100, 0), (1, 150, 0), (1, 200, 0), (2, 100, 0), (2, 150, 0), (2, 200, 0), (5, 200, 0) and (1, 50, 0.01).

Fifield et al. (2005) looked at the extent of efficiency in European Stock Markets by examining two of the simplest and most popular classes of rules: filter rules and moving average rules. The chosen markets were classified by the authors into three categories, namely: four "emerging" markets (Greece, Hungary, Portugal and Turkey[34]), four "smaller developed" markets (Finland, Italy, Ireland and Spain) and three "major developed" markets (France, Germany and the UK). The sample used was daily data from January 1991 – December 2000. Ten different filters, ranging from 1 per cent to 30 per cent were used as were 10 variations of the moving average rule[35]. The implementation of filter rules on the emerging markets showed that over half of the strategies outperformed the naïve strategy, with smaller filters (1, 2.5 and 5 per cent) performing best in the smaller emerging markets (Hungary and Turkey). The smaller filters also dominated the buy and hold strategy in all the emerging markets despite incurring higher transaction costs due to frequent trading. For example, the 1 per cent filter for Turkey proved to be the most profitable overall (at 524.5 per cent) whereas the buy and hold strategy yielded -0.3 per cent, evidence consistent with previous findings (e.g. Sweeney, 1988, 1990). The results as a whole showed that profitable filters tend to be associated with the smaller developed stock markets; no filter[36] strategy outperformed the naïve strategy in the large developed markets.

These results are consistent with Coutts and Cheung (2000); Parisi and Vasquez (2000); Gunasekarage and Power (2001) in indicating a degree of

[34] Antoniou et al., (1997) used 63 stocks traded on the Istanbul Stock Exchange over the period January 1988 – December 1993 to show that the market conformed to weak form efficiency. The moving average model was used and the results showed considerable evidence of predictability for over half the returns even after taking account of risk when returns were conditioned on the past sequence of volume and returns. It appeared that volume has a useful role in predicting returns.

[35] The filter sizes were 1, 2.5, 5, 7.5, 10, 12.5, 15, 20, 25 and 30 per cent. The moving average rules employed were (1, 50, 0), (1, 50, 0.01), (1, 150, 0), (1, 150, 0.01), (2, 100, 0), (2, 100, 0.01), (2, 200, 0), (2, 200, 0.01), (5, 200, 0) and (5, 200, 0.01).

predictability and consistency amongst the rules. For the smaller developed markets, the profits from the moving averages rules exceeded the buy and hold strategy when the lengths of the short and long run moving averages were shortest (1 and 50); when at their longest (5, 200), however, only Turkey was profitable. Overall, 46 out of 70 rules investigated for the developed markets underperformed the naïve strategy, after generating large losses. The moving average rules did not appear to have predictive power in such markets.

For Middle Eastern markets, Shachmurove et al., (2001) investigated the use of technical trading rules in Israel, by analysing daily data for the Tel – Aviv 25 Index (TA25) and comparing rule performance thereon with returns on the Standard and Poors 500. The time period investigated was August 1993 – June 1999. The long moving averages tested were for 9, 49, 99 and 149 days and the short moving average was 1 day. For the 9 and 49 day versions, the trading rules (yielding 263 per cent) outperformed the buy and hold strategy (200 per cent), with a 78.5 per cent success rate and a positive overall trend. For the 99 and 149 day rules, the buy and hold method produced higher returns, (with negative trends being evident) than did the trading rule.

Atmeh and Dobbs (2006) examined the performance of 14 different moving average[37] trading rules applied to index returns on the Jordanian stock market. A daily data series was examined for the Amman stock exchange (ASE) over the time period January 1992 – July 2001, with up to 70 companies included in the analysis. The buy returns were all positive, with an average 1-day return of 0.06 per cent compared to an unconditional mean of 0.0154 per cent. Also, 4 out of the 14 tests

[36] Filters up to 10 per cent beat the buy and hold strategy in all the emerging markets with the exception of Portugal.
[37] The rules used were (1, 2, 0), (1, 5, 0), (1, 10, 0), (1, 25, 0), (1, 50, 0), (1, 100, 0), (1, 150, 0), (1, 200, 0), (5, 10, 0), (5, 25, 0), (5, 50, 0), (5, 100, 0), (5, 150, 0) and (5, 200, 0).

supported rejection of the null hypothesis that the average buy return equalled the unconditional average return. For sells, all the returns were negative with an average one-day figure of -0.03 per cent resulting in 4 of the 14 tests suggested rejection of the null hypothesis before transaction costs. After transaction costs, there was some indication that the buy returns were significant for short moving average rules and the sell returns less significant. Most of the trading rules did not work, but some of the shorter ones ((1, 2, 0); (1, 5, 0); (1, 10, 0); (1, 25, 0)) appeared to be profitable after transaction costs, and had significant predictive power (as did the (1, 50, 0); (5, 10, 0); (5, 25, 0) rules).

Al-Abdulqader et al. (2007) examined the Saudi Stock Market weekly data for 45 companies spanning over the period July 1990 – August 2000 using both the filter and moving average rule[38]. The filter rules outperformed the buy and hold strategy on average, with the 7.5 per cent filter rule proving to be the most profitable for 35 out of the 45 companies examined. In addition, the filter rule outperformed the naïve strategy by between 56 per cent and 78 per cent with the 10 per cent filter being the most profitable as it generated the highest returns for 13 out of 45 companies. As regards the moving average rule, the strategies (1, 50, 0) and (1, 50, 1) performed best, producing significantly greater returns than the buy and hold strategy. The rule was not successful, however, in predicting share prices when the long run average was set at 150 days. In a slight majority of cases (93 out of 180), the moving average rule beat the buy and hold strategy.

Some support for the use of trading strategies in a South American context has been provided by Parisi and Vasquez (2000), who employ the moving average and TRB rule (with similar variations to Brock et al. 1992) on the Chilean Stock Market

over the period January 1987 – September 1998 using daily data. The results showed that for the VMA rules all the buy returns were positive, with an average return of 0.165 per cent. For the sell signals returns were negative, averaging -0.0512 per cent. In addition, 7 out of the 10 tests supported rejection of the null hypothesis of equal returns. For the FMA rules, all the buy signals rejected the null, producing an average return of 3.793 per cent; for the sell signals, 5 out of 10 tests rejected the null hypothesis with a mean return of 1.117 per cent, but no clear overall pattern emerged.

A range of Latin American and Asian markets was investigated by Ratner and Leal (1999) to examine the potential profitability of several trading rules. A total of 10 equity markets[39] were investigated over the time period January 1982 – April 1995. The trading strategies employed were similar to Brock et al. (1992): 10 VMA rules were alongside the bootstrapping technique, and the returns compared with quoted by a buy and hold strategy[40]. Amongst Latin American markets, only Mexico provided evidence of significant rule – based profits. In contrast, in Asia the strategies yielded significant profits in all countries except India; Taiwan and Thailand achieved superior returns when compared to buy and hold strategy even in a costly trading environment.

Fifield et al. (2008) presented a comprehensive study of 15 emerging markets, categorised by the authors as: three Latin American countries (Argentina, Chile, Mexico), three European, African and Middle Eastern countries (South Africa, Turkey, Zimbabwe); nine Asian countries (Hong Kong, India, Indonesia, Korea, Malaysia, the Philippiness, Sri Lanka, Taiwan and Thailand); and three developed

[38] The five filter rules in question were 1 per cent, 2.5 per cent, 5 per cent, 7.5 per cent and 10 per cent. The four moving average variations were (1, 50, 0), (1, 50, 1), (1, 150, 0) and (1, 150, 1).
[39] Daily inflation adjusted data was gathered for the markets of Argentina, Brazil, Chile, Mexico, India, Korea, Malaysia, Philippines, Taiwan and Thailand.
[40] Unlike Brock et al. (1992), the study used trading bands of 0 and 1 and the standard deviations of the actual inflation adjusted return series.

markets (Japan, U.K and U.S). Daily data over a 15 year timeframe 1989 – 2003 was employed to examine the profitability of the moving average[41] rules in a costly trading environment.

On inspecting the data, the daily mean returns were found to be widely spread, ranging from -0.04 per cent to 0.08 per cent. All the values for every emerging market were positive for the 10-day and 150-day periods. As the length of the long run moving average increased, the number of countries where the moving average rule profits were greater than the buy and hold returns decreased. For example, for the 50-day moving average, 12 emerging countries generally had higher rule – based than buy – and – hold profits; when the rule increased from 50 to 200 days, the figure fell from 12 markets to 9. The short – run moving average rule results generated similar evidence; as the length of the short run moving average increased, the profit in the emerging markets decreased. In particular, there was a marked fall in rule profit as the short run period increased from 1 to 10 days in the emerging markets. Finally, 9 out of the 15 emerging markets (Argentina, Chile, Indonesia, the Philippines, South Africa, Turkey and Zimbabwe) found the (1, 50, 0) rule to be the most profitable.

For the developed markets, the moving average rules did not have predictive ability in terms of stock market returns, while the buy and hold strategy produced negative returns over the period studied. On performing timing tests on the data (i.e. to see if a buy (sell) signal generated a positive (negative) return) the authors found that there were trends in the data, but primarily in the emerging markets. The conclusion reached in the study was that the moving average rules were more profitable when tested using emerging stock markets, with the profitability persisting

[41] A total of 36 rules were tested: (1, 50, 0), (1, 50, 1), (1, 50, 5), (1, 100, 0), (1, 100, 1), (1, 100, 5), (1, 150, 0), (1, 150, 1), (1, 150, 5), (1, 200, 0), (1, 200, 1), (1, 200, 5), (5, 50, 0), (5, 50, 1), (5, 50, 5), (5, 100, 0), (5, 100, 1), (5, 100, 5), (5, 150, 0), (5, 150, 1), (5, 150, 5), (5, 200, 0), (5, 200, 1), (5, 200, 5),

for longer moving average periods. In general, the study suggests that emerging markets were informationally inefficient in the weak form sense at the time of analysis, both in absolute terms and relative to published evidence about the developed markets.

2.8 Conclusion

This chapter has reviewed previous empirical evidence regarding the extent of weak form efficiency in the pricing of equities on global stock markets. The vast body of work was categorised on two dimensions: (i) developed v's emerging market status; and (ii) statistical v's trading rule – based studies. What is clear from the literature is that the conclusions which can be drawn are contingent on time – period, market location and research techniques employed. However, there do appear to be grounds for suggesting that the extent of efficiency amongst emerging markets – the focus of the present study – is less than in developed stock markets. Taking the above into account it is evident that a need exists for a study of emerging markets that is up to date and comprehensive in terms of analysing several markets and employing a range of analytical techniques, but with a focus on: (i) the use of strategies such as the moving average and filter rule which are sophisticated, but do not make unrealistic assumptions about the underlying distortion of price changes; and (ii) a region that has been relatively under – researched so far, i.e. Central and Eastern Europe.

(10, 50, 0), (10, 50, 1), (10, 50, 5), (10, 100, 0), (10, 100, 1), (10, 100, 5), (10, 150, 0), (10, 150, 1), (10, 150, 5), (10, 200, 0), (10, 200, 1), (10, 200, 5).

Chapter Three

An Overview of the CEE Stock Markets

3.1 Introduction

Exceptional growth in the value of funds invested in emerging markets has been witnessed in recent years (Fifield et al., 2002). In addition to the literature outlined in the previous chapter, academics have explored the reasons for the increase in investment levels; these studies point to: (i) the improved political situation in the countries concerned; (ii) the relaxation of restrictions on foreign investment; and (iii) the low degree of correlation analysis amongst share returns across the market (Gilmore and McManus, 2002; Syriopoulos, 2004; Patev et al., 2006).

Recently, the region of Central and Eastern Europe (CEE) has been targeted by investors and academics, reflecting these developing post – communist countries' tendency to experience high growth levels. The stock markets of Central and Eastern Europe are relatively new when compared to other emerging markets but, despite their short history, the markets have already survived several crises, including the Russian Rouble difficulties in 1998 (Patev et al., 2006). As time has progressed, key characteristics of the EU economies have been mirrored in the CEE region (Claessens et al., 2003); however, the internationalisation of the EU accession countries could make it more difficult for the exchanges to survive independently, especially the smaller ones. If market performance proves to be poor, the knock – on effects could impact on both the real and financial economies of the nations concerned (Claessens et al., 2003). Clearly the on – going difficulties in financial markets may impact on the CEE markets in future years and potentially endanger their independence.

The next two sections of the chapter are devoted to defining an "emerging" stock market and investigating the extent to which the CEE markets' properties coincide with those of an "emerging market". Section 3.4 of the chapter then looks at economic performance in the region. Section 3.5 discusses the attractiveness of

investing in the CEE region while Section 3.6 analyses the barriers to investment in the CEE region. Section 3.7 summarises some of the key characteristics of the CEE markets, before Section 3.8 offers some concluding remarks on the chapter.

3.2 Defining Emerging Stock Markets (ESMs)

The term "emerging market" was originally coined by the International Finance Corporation (IFC) to describe a fairly narrow list of middle – to – higher income developing economies with stock markets in which foreigners could buy securities. The term's meaning has since been expanded to include more or less all developing countries (Fifield et al., 2002). Developing countries are those with a Gross National Income (GNI) *per capita* of $9,265 or less (IFC, 2002). The World Bank definition classifies' economies as "low – income" (GNI $755 *per capita* or less), "middle – income" (GNI $756 – 9,265 *per capita*) and "high – income" (GNI $9,266 *per capita* or more). Low – and middle – income economies thus classified are referred to as developing countries (IFC, 2002). A more recent definition of emerging markets is from the IFC (2008) who stated that emerging markets were typically countries with low – middle *per capita* income that have undertaken economic development and reform programs and have begun to "emerge" as significant players in the global economy. This shows us that emerging markets are becoming much more significant.

Divecha et al. (1992) attempted to define narrowly the characteristics of an emerging market. The attributes needed for an exchange to be classified as an emerging market according to the authors were: (1) that securities are traded publicly; (2) it is not a developed market (as defined by the Morgan Stanley Capital International (MSCI) or Financial Times Indices; (3) it is of interest to global

investors; and (4) reliable sources of data are available. The study also suggests that emerging markets can be classified as belonging to one of three regions: Asia; Latin America and Europe; and the Middle East and Africa.

In 1981, the IFC created the Emerging Market Database (EMDB) to help produce standardised stock indices for developing countries and fulfil a perceived need for a more comprehensive way of evaluating emerging stock market performance. The EMDB classified a stock market as "emerging" if it met one of two criteria: (1) it is located in a low or middle income economy as defined by the World Bank; and / or (2) its market capitalisation is low, relative to its most recent GNI figures. In order for these emerging markets to "graduate" from the EMDB Index, two criteria must be met: (1) the GNI *per capita* must be in the high income economy range for three years in a row; and (2) the market capitalisation to GNI ratio must be in the top 25 per cent of emerging markets, again for three years in a row (Standard & Poor's, 2001).

The term "emerging market" was defined in a wider way by the International Monetary Fund (IMF), who consider all stock markets that are in developing countries to be emerging. The IMF considered all low – to – middle income countries with undeveloped stock markets, low industrialisation, political instability and low to middle *per capita* income to be "developing" (Lonie et al., 1997). As the discussion above illustrates, the modern definition of an "emerging market" takes many forms and none is universally accepted.

3.3 CEE Markets Classification as Emerging

In this dissertation, data from nine stock markets located in the Central and Eastern European region are investigated. The markets involved are those operating

in: Croatia, the Czech Republic; Estonia; Hungary; Poland; Romania; Russia, Slovenia; and Turkey. These countries were picked primarily because of data availability. The UK is also included, as a developed market, to enable comparisons to be made between the data in the emerging CEE region and a major established exchange. Table 3.1 provides data on: Gross National Income (GNI) *per capita*; GNI; Market Capitalisation divided by GNI; and Market Capitalisation for each of the countries. On a preliminary inspection of the data, it is clear that the GNI in the CEE countries, both in total initial and *per capita*, was very low when compared to the UK. However, GNI in the CEE region appears to be growing, with the highest rates being recorded from 2003 onwards. For example, the highest growth rate in GNI for the emerging markets for the year 2000 – 2005 was the Russian Federation with a figure of 154.93 per cent[42]; the UK managed a growth rate of only 51.93 per cent over this period.

According to the World Bank definition, six of the CEE countries included in this study (Croatia, Estonia, Poland, Romania, the Russian Federation and Turkey) are classified as "middle income", with the remaining three (the Czech Republic, Hungary and Slovenia) being "high income". This means that those three countries are developed markets, not emerging markets. None of the countries meet the IMF criterion for emerging market status' as none of the economies were classified as low income. However, geographically, economically and in terms of market characteristics these nations have more in common with the rest of the CEE countries in the table than Western European nations such as the UK and are thus included in the analysis from here onwards. In addition, all nine markets under investigation meet Divecha's (1992) criteria for emerging market status as they all have securities

[42] Although most of the countries experienced growth throughout the five – year period there were

that trade in a public market. Moreover, none of the markets appear in the Morgan Stanley Capital International Indices (MSCIs), and are therefore not "developed" according to this standard.

In terms of the ratio of market capitalisation to GNI, the Russian Federation recorded the highest ratio, reaching 0.8597 in 2005[43]. The lowest ratio over the period 2000 – 2005 was 0.1392 for Croatia, in the year 2000. These figures were consistently dwarfed by those for the UK; for example, in 2005 its ratio was 1.2390. By the end of 2005, the highest stock market capitalisation figures among the nine ESMs was recorded by the Russian Federation ($548.6 billion), followed by Turkey and Poland, but the Russian[44] figure remains small on a worldwide scale, as the UK's 2005 market capitalisation of $2816 billion. The remainder of the stock markets were much smaller than Russia's; this appears to reflect both the small size of the population (e.g Estonia, Latvia and Slovenia) and poor economic development and regulatory framework (e.g. Romania). The development of the CEE regions' market capitalisation figures reflects their chosen privatisation method; for example, the countries that followed a more gradual approach towards privatisation experienced a relatively slow increase in market capitalisation (e.g. Hungary and Poland). However, in some cases privatisations led to market capitalisation jumping to high levels – (and even maturing to the extent that the increase was tempered by rapid delisting of illiquid companies) – (e.g. the Czech Republic) (Pajuste, 2002).

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some exceptions, e.g. Slovenia and Turkey suffered a few decreases in growth in the earlier years.

[43] Slovenia generated the lowest value for 2005 of 0.2263.

[44] Lesmond (2005) found that the Russian market has high volatility – and lower price and trading volume – than other emerging markets.

Table 3.1

Economic Statistics and Market Capitalisation by Country, 2000 – 2005.

Country	Indicator	2000	2001	2002	2003	2004	2005
CRO	GNI per capita (current US$)	4,500	4,390	4,630	5,370	6,820	8,290
	GNI (current US$ m)	19,702.70	19,513.57	20,547.90	23,886.40	30,300.00	36,900.00
	Market Cap./GNI	0.1392	0.1701	0.1935	0.2565	0.3617	0.3501
	Market Capitalisation (US$ m)	2,742.00	3,319.00	3,976.00	6,126.00	10,959.00	12,918.00
CZE	GNI per capita (current US$)	5,690	5,650	5,880	7,190	9,130	11,220
	GNI (current US$)	58,468.98	57,814.83	60,004.77	73,302.93	93,300.00	114,800.00
	Market Cap./GNI	0.1882	0.1614	0.2649	0.2410	0.3308	0.3340
	Market Capitalisation (US$ m)	11,002.00	9,331.00	15,893.00	17,663.00	30,863.00	38,345.00
EST	GNI per capita (current US$)	4,070	4,200	4,540	5,380	7,080	9,060
	GNI (current US$ m)	5,569.59	5,730.25	6,160.86	7,277.14	9,500.00	12,200.00
	Market Cap./GNI	0.3314	0.2588	0.3944	0.5208	0.6529	0.2865
	Market Capitalisation (US$ m)	1,846.00	1,483.00	2,430.00	3,790.00	6,203.00	3,495.00
HUN	GNI per capita (current US$)	4,650	4,700	5,100	6,360	8,370	10,070
	GNI (current US$ m)	46,626.07	47,854.76	51,831.20	64,382.23	84,600.00	101,600.00
	Market Cap./GNI	0.2578	0.2166	0.2529	0.2598	0.3394	0.3206
	Market Capitalisation (US$ m)	12,021.00	10,367.00	13,110.00	16,729.00	28,711.00	32,576.00
POL	GNI per capita (current US$)	4,430	4,530	4,680	5,280	6,100	7,160
	GNI (current US$ m)	171,038.40	173,173.50	179,059.30	201,735.20	232,900.00	273,100.00
	Market Cap./GNI	0.1829	0.1502	0.1606	0.1842	0.3053	0.3437
	Market Capitalisation (US$ m)	31,279.00	26,017.00	28,750.00	37,165.00	71,102.00	93,873.00
ROM	GNI per capita (current US$)	1,680	1,740	1,910	2,260	2,960	3,910
	GNI (current US$ m)	37,664.88	38,487.01	41,736.99	49,050.82	64,200.00	84,600.00
	Market Cap./GNI	0.0284	0.0552	0.1093	0.1138	0.1836	0.2434
	Market Capitalisation (US$ m)	1,069.00	2,124.00	4,561.00	5,584.00	11,786.00	20,588.00
RUS	GNI per capita (current US$)	1,720	1,790	2,120	2,610	3,400	4,460
	GNI (current US$ m)	250,308.50	259,626.40	305,521.00	373,874.30	488,500.00	638,100.00
	Market Cap./GNI	0.1555	0.2935	0.4065	0.6173	0.5485	0.8597
	Market Capitalisation (US$ m)	38,922.00	76,198.00	124,198.00	230,786.00	267,957.00	548,579.00
SLO	GNI per capita (current US$)	10,500	9,760	10,370	11,920	14,770	17,440
	GNI (current US$ m)	20,000.00	19,400.00	20,400.00	23,800.00	29,500.00	34,900.00
	Market Cap./GNI	0.1274	0.1463	0.2258	0.2189	0.3280	0.2263
	Market Capitalisation (US$ m)	2,547.00	2,839.00	4,606.00	5,209.00	9,677.00	7,899.00
TUR	GNI per capita (current US$)	3,100	2,530	2,490	2,800	3,750	4,750
	GNI (current US$ m)	202,100.00	167,300.00	173,300.00	197,800.00	269,000.00	342,000.00
	Market Cap./GNI	0.3447	0.2818	0.1959	0.3457	0.3654	0.4723
	Market Capitalisation (US$ m)	69,659.00	47,150.00	33,958.00	68,379.00	98,299.00	161,537.00
UK	GNI per capita (current US$)	25,410	25,310	25,560	28,320	33,630	37,740
	GNI (current US$ m)	1,495,908.00	1,494,779.00	1,514,022.00	1,680,255.00	2,013,400.00	2,272,700.00
	Market Cap./GNI	1.7227	1.4482	1.2313	1.4641	1.1982	1.2390
	Market Capitalisation (US$ m)	2,576,992.00	2,164,716.00	1,864,262.00	2,460,064.00	2,412,434.00	2,815,928.00

Note: This table provides background economic and market data about the nine CEEs countries in the sample, along with the UK for comparative purposes. GNIs = Gross National Income. Market Cap./GNI is the ratio of market capitalisation to the GNI of the country concerned. Source: "World Development Indicators" 2001 – 2007

3.4 The Economic Performance of the CCE Countries

As recently as 2000, many of the CEE stock markets were seen as being underdeveloped and unimportant economically when compared to their western counterparts (Köke and Schröder, 2003). However, since then, economic developments have led to rapid changes in the region; Table 3.2, which debates the economic performance of the nine CEE nations (and the UK) over the period 2001 – 2005, highlights the improved performance in recent years. From examination of the Gross Domestic Product (GDP) figures in Table 3.2, it is apparent that year – on – year growth occurred in for all the countries listed; this improvement may well reflect the macroeconomic developments that have gone hand – in – hand with stock market development over the period. However, the GDPs of the CEE nations are small when compared to the developed market of the UK. For example, the highest GDP in 2005 amongst the CEE countries was around $763 billion (for the Russian Federation) while the equivalent figure for the UK was around $2,198 billion. Of all the CEE nations, only three (Poland, Turkey and the Russian Federation) had achieved GDP of $150 billion by the end of the period. However, the Czech Republic and Hungary consistently achieved a GDP of over $100 billion. In contrast, Croatia, Estonia and Slovenia recorded the lowest GDPs, in all cases

Table 3.2

Economic Indicators for the CEE Countries, 2001 – 2005

		GDP (US$ million)	GDP Percentage Growth from 2001 – 2005 (%)	Inflation, GDP deflator (annual %)	Net income (US$ millions)	Current account balance (US$ millions)	Total reserves (US$ millions)	Imports of goods and services (US$ millions)	Exports of goods and services (US$ millions)
CRO	**2001**	20,260		72.2	-537	-617	4,703	10,677	9,631
	2002	22,436		61.3	-518	-1,606	5,885	12,709	10,545
	2003	28,797		53.0	-1,213	-2,085	8,191	17,196	14,929
	2004	34,311		3.3	-772	-1,641	8,758	20,180	17,828
	2005	38,506	90	3.6	-1,213	-2,585	8,800	21,702	18,876
CZE	**2001**	56,784		10.6	-1,540	-2,624	14,464	42,049	40,495
	2002	69,514		9.9	-3,800	-4,485	23,707	47,159	45,562
	2003	89,715		9.1	-4,166	-5,661	26,955	58,561	56,526
	2004	107,015		3.2	-5,433	-5,595	28,451	76,966	76,569
	2005	124,365	119	2.5	-5,929	-2,495	29,554	86,461	89,007
EST	**2001**	5,525		46.1	-281	-339	822	5,190	4,981
	2002	6,507		40.3	-331	-802	1,003	6,119	5,504
	2003	9,082		35.5	-577	-1,199	1,377	7,566	6,837
	2004	11,239		3.7	-718	-1,432	1,792	9,674	8,794
	2005	13,101	137	3.9	-700	-1,445	1,947	11,784	10,939
HUN	**2001**	51,926		18.3	-1,488	-1,097	10,755	35,633	35,778
	2002	65,843		17.4	-1,586	-2,644	10,383	44,104	42,599
	2003	82,732		16.4	-4,455,	-7,364	12,780	54,766	51,203
	2004	100,685		7.4	-6,086	-8,842	15,951	69,425	66,351
	2005	109,239	110	6.1	-6,915	-8,106	18,590	75,596	74,168
POL	**2001**	176,256		21.3	-1,390	-5,357	26,563	58,275	51,419
	2002	189,021		19.8	-1,887	-5,007	29,784	63,177	56,777
	2003	209,563		17.7	-4,603	-3,639	33,959	77,379	72,181
	2004	242,293		2.0	-11,399	-10,357	36,773	99,935	95,333
	2005	303,229	72	2.4	-11,186	-5,105	42,561	113,476	112,622
ROM	**2001**	38,718		91.0	-282	-2,317	6,377	16,557	13,379
	2002	45,749		84.3	-459	-1,525	8,372	18,825	16,223
	2003	56,951		78.1	-705	-3,311	9,449	25,113	20,646
	2004	73,167		23.3	-1,766	-5,589	16,095	34,029	27,099
	2005	98,565	154	21.8	-2,900	-8,504	21,605	42,866	32,813
RUS	**2001**	309,951		139.6	-3,959	34,621	36,303	73,168	112,507
	2002	346,520		121.1	-6,117	29,905	48,326	85,188	121,214
	2003	432,855		106.4	-13,171	35,845	78,409	102,558	151,959
	2004	581,447		15.8	-13,000	59,920	126,258	130,144	203,741
	2005	763,760	146	16.8	-1,911.1	83,184	182,272	164,718	268,136
SLO	**2001**	18,810		18.3	19	31	4,397	11,420	11,302
	2002	21,960		10.2	-71	375	7,063	12,452	12,764
	2003	27,749		9.6	-188	-99	8,598	15,727	15,709
	2004	32,182		6.4	-300	-670	8,900	19,927	19,519
	2005	34,354	83	5.5	-363	-682	8,160	22,319	22,121
TUR	**2001**	147,683		74.2	-5,000	3,396	19,911	45,845	50,438
	2002	183,665		71.8	-4,549	-1,482	28,348	55,046	54,617
	2003	240,376		68.7	-5,427	-7,905	35,549	73,797	70,292
	2004	302,786		31.9	-5,519	-15,543	37,304	102,199	91,048
	2005	362,502	145	25.5	-5,663	-23,155	52,494	121,766	102,806
UK	**2001**	1,424,094		2.8	13,166	-30,277	40,442	418,989	385,830
	2002	1,566,283		2.8	31,255	-14,414	42,819	436,634	404,794
	2003	1,794,878		2.7	35,771	-28,645	46,052	506,919	457,090
	2004	2,124,385		2.8	48,582	-42,511	49,740	604,562	533,167
	2005	2,198,789	54	2.5	54,814	-49,459	43,593	669,823	587,541

Note: This table shows the Gross Domestic Product (GDP), the inflation in terms of GDP, the net income, the current account balance, total reserves and the import and export of goods and services over the time period 2001 – 2005. Source: "World Development Indicators" 2003 – 2007.

remaining well below $50 billion. Returning to the growth rates, an inspection of Table 3.2 shows that the UK achieved growth of 54 per cent in GDP over the time period 2001 – 2005, but all of the CEE countries attained a higher rate of increase. The highest growth of GDP was achieved by Romania, with an increase of 154 per cent over the period, but even the lowest GDP growth rates (in Poland, Slovenia and Croatia) of 72 per cent, 83 per cent and 90 per cent respectively were markedly higher than for the only developed nation shown in the table. Surprisingly, in the contest of the World Bank terminology, of the three markets that were classified as "high income" economies, only the Czech Republic achieved GDP of over $100 billion in 2005[45].

Table 3.2 also provides data on the GDP deflator, which acts as a measure of inflation, and highlights how well each macro economy is being controlled (Pajuste, 2002). For example, the UK had an inflation rate of below 3 per cent over the sample time period, implying good control over their economy, while six of the CEE countries (Croatia, the Czech Republic, Estonia, Hungary, Poland and Slovenia) had reduced inflation to under 6.5 per cent by 2005. These inflation rates almost certainly reflect the integration of these countries into the European Union (EU) and the adoption of a common monetary policy. For example Poland, Hungary and the Czech Republic adopted EU norms regarding commercial and economic legislation to conform with the EU Association Accords prior to accession (Lorinc, 1995). In contrast, there were much higher inflation rates in Romania, the Russian Federation and Turkey. The Romanian inflation rate exceeded 20 per cent in the year 2005;

[45] Hungary's and Slovenia's GDP was $109 billion and $34 billion respectively.

while the Russian Federation had an inflation rate of 139.6 per cent in 2001, but managed to reduce it to 16.8 per cent by 2005. Turkey managed to reduce its inflation rate from 74.2 per cent in 2001 to 25.5 per cent in the year 2005. Overall, these figures reveal a degree of variability among the nine ESMs, even after pervasive improvements over the 2001 – 2005 period.

The net income figures relate to the amount of investment that took place in the countries in question. All of the CEE countries reported a deficit in net income with the one developed nation, the UK, again differing, by having a positive figure. As the years passed, the deficits generally increased, as did the UK's surplus. The current account balances were mainly negative through the time period, although Slovenia in 2001 and 2002 had a positive account balance. More notably, the Russian Federation stood out as the only country to achieve a positive balance on its current account over the whole period. Total reserves are another key economic indicator, as they can be used when a nation runs short of financial resources and thereby lessen the danger of economic distress (Pajuste, 2002). The largest growth of reserves over the period was achieved by the Russian Federation, which saw growth from $36,303 million in 2001 to $182,272 million in 2005. This increase largely reflects increases in the nation's oil revenues. In February 2002, the nation overtook Saudi Arabia as the world's largest oil producer (Hill and Lee, 2002) and substantial increases in revenues followed. The increases in total reserves for the CEE countries were greater than the UK market; the UK only managed an increase from $40,442 million to $43,593 million over the period 2001 – 2005, whereas Poland's, whose total reserves growth was the lowest out of the CEE markets, still saw growth from $26,563 million in 2001 to $42,561 million in 2005.

Finally, the table reports on the import and exports of goods and services for the CEE countries and the UK; although this data underpins the current amount figures mentioned earlier, the disaggregated information reveals some notable trends. For example, the current account balances of Hungary and Romania were similar, despite the imports and exports both consistently being twice as high for the former. The Russian Federation was once again out of line, in this case via imports and – most substantively – exports that far exceeded the other CEEs (but not the UK). Poland's export growth was high rising from $51,419 million to $112,622 million over the period in question; this was mainly due to the pro – foreign trade polices of their government, which in turn boosted the nation's GDP growth figures (Lornic, 1995). Taken together, the picture that emerges from Table 3.1 and 3.2 is one of a common pattern in the market and economic status of the emerging nations in CEE under investigation here. In contrast, the developed country of the UK differed from all nine in virtually every respect across all time periods. The only CEE nation where idiosyncrasies appeared to exist was the Russian Federation and this needs to be borne in mind in the empirical section of this dissertation.

3.5 The Attractions of CCE Markets

Divecha et al. (1992) argue that emerging markets became increasingly accessible to global investors throughout the 1980s. The IFC estimated that as many as 30 per cent of the emerging markets were open to foreign investment by 1993 (Lorinc, 1995). In terms of tangible rewards, Speidell and Sappenfield (1992) argue that emerging markets had higher risk and return than developed markets, differences that can be exploited by careful portfolio management. Similarly Harvey (1995)

found that emerging markets can improve the performance of an equity portfolio that invests only in developed stock markets.

The Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovenia and Slovakia were accepted as members of the European Union (EU) in 2004, with Bulgaria and Romania joining in 2007. In order for the countries to ascend towards EU membership, they were required to comply with a number of political, economic and institutional requirements. Most importantly, one of the main criteria was that each accession state must be able to guarantee the existence of a fully functioning market economy. Clearly, a reliable stock exchange underpins such status, with markets required to exhibit some degree of efficiency at the allocational, functional and informational levels, as well as reliability and maturity (Lorinc et al. 1995). Each of the new member states have been enhancing their investor protection policies and developing their stock markets along these lines (Cajueiro and Tabak, 2006) and this is reflected in the growth in markets documented in Table 3.1 (see also Gilmore et al., 2005).

Adopting an investor's perspective, Köke (1999) conducted a survey which sought to identify the criteria for emerging market investment – and the trading barriers working against it – that were perceived by western portfolio managers operating in the CEE regional markets. The study employed 21 questionnaires sent to 19 different fund managers operating in six CEE markets: the Czech Republic; Estonia; Hungary; Poland; Russia; and Slovenia. The portfolio managers were asked to judge each country's performance by rating general, macroeconomic, financial market and microeconomic factors. The majority of the respondents identified Hungary as the best performing market, with Poland and Estonia following respectively. The worst performing countries were the Czech Republic and Russia;

Russia received the lowest rating in all categories, which again points to the unique character of the Russian markets within the CEE region. Other than the Czech Republic, the EU accession states were seen as having only minor problems in the political and macroeconomic department. Overall, the study concludes that Hungary is the nation with the least significant barriers to investment problems and the Czech Republic and Russia having the most potential difficulties; the issue of barriers is returned to in detail in Section 3.6.

More recently, Middleton et al. (2007a) conducted a series of interviews with investment professionals to examine rationales for undertaking investment in the CEE stock markets. For the managers of CCE – specific funds, the issue of convergence was seen as a catalyst for growth in the region and appeared to act as the main motivation for investment. However, the global emerging market managers focused primarily on valuation and growth and seemed less interested in specific regional issues. All the interviewees indicated that they viewed their investment in the CEE region as being a long – term oriented strategy, typically, taking a five – year view when evaluating potential investments[46]. In general, there appears to be a clear trend towards institutional investment in CEE region and this is set to grow as the nations become more integrated into the global economy.

A second paper by Middleton et al. (2007b) focused on the nature of the gains from investing in the CCE region. The study analysed 187 securities that were traded in eight CCE markets: Croatia (with a sample of 2 shares); the Czech Republic (41); Estonia (11); Hungary (30); Latvia (6); Poland (70); Romania (22); and Russia (5), using weekly returns over the six year period January 1998 – December 2003[47]. On

[46] This evidence is consistent with earlier findings in Helliar et al. (2000).
[47] The unbalanced sample reflects data availability as some companies did not trade for the entire sample period.

calculating the mean return per unit of risk (MRPUR)[48] for each year, the highest figure that resulted was 0.7522 for the Czech Republic in 2003, higher than the developed market benchmark figure. The lowest MRPUR was the -0.3538 for Poland in 2001. Middleton et al. (2007b) concluded that the strongest gains from diversification happened when shares were picked from different countries. This evidence suggests that even taking into account the high risk nature of the Czech Republic environment noted by Köke (1999), the Prague market provides investors with tangible potential rewards.

Lorinc (1995) concluded that several countries in Central Europe (the Czech Republic, Hungary, Poland, the Slovak Republic) had generated faster economic growth than their developed counterparts and it was reasonable to assume that the stock market returns in the medium to long – term would reflect this. Also, with increasing demand and global economic growth expected to last for a significant period of time at the time of his study, Lorinc argued that the strong performance of emerging markets should persist.

Köke and Schröder (2003) considered the future prospects for the markets in the CCE region, focussing in this case on: Czech Republic; Estonia; Hungary; Latvia; Lithuania; Poland; Slovakia Republic; and Slovenia. The best developed markets were found to be the Czech Republic, Hungary and Poland, as these all had market liquidity that was comparable to that found on Western European Stock markets. On further analysis, however, the authors' note that CEE markets as a whole were not performing to the highest possible standards. The reasons for this were suggested as being the lack of new assets provided by the companies via Initial Public Offerings (IPOs) and Seasonal Public Offerings (SPOs) (with the exception of the Hungarian

[48] The MRPUR is the ratio of the mean return to the standard deviation of returns. The ratio shows the

market). This factor was seen as potentially hampering future growth in market capitalisation and turnover on the CEE exchanges. Also, in the event of a worldwide downturn in share prices and turnover – which has of course subsequently occurred – the CEE exchanges could be damaged disproportionately.

The relationship between economic fundamentals and equity market performance in the CEE region was investigated by Hanousek and Filer (2000) on the basis of the data for four former communist bloc countries (the Czech Republic, Hungary, Poland and Slovenia). For the Czech Republic, none of the lagged economic variables were found to be linked with returns. Returns on both the Polish and Hungarian markets were shown to be most closely linked to economic performance in domestic and in developed countries. The authors conclude that a risk adverse investor should be wary of committing significant funds in the Prague market.

The theoretical benefits of portfolio diversification have been highlighted in a number of well – known studies (e.g. Markowitz, 1952; Grubel, 1968), with the focus being on the benefits of diversification in terms of efficient risk reduction. More recently, Solnik (1995) showed that advantages in risk reduction could be gained from a portfolio diversified in both foreign and domestic securities. After investigating portfolios containing different numbers of stocks, Solnik's results make clear that substantial reductions in portfolio standard deviations could be made with international diversification, primarily because the returns on the different securities may not be perfectly positively correlated. This latter point, which employs Markowitz's central concept, is one of the main rationales provided by academics for the growth in ESM investment, i.e. the lower correlations both therein and with developed market securities.

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trade-off between risk and return that an investor may face.

The Markowitz principles were central to the analysis of the benefits of ESM diversification investigated in a number of early studies (Levy and Sarnat, 1970; Lessard, 1973), and a recent resurgence in interest in the topic, foundation a similar basis, has occurred (e.g. Bailey and Stulz, 1990; Bailey and Lim, 1992; Fifield et al, 1999, 2002; Gilmore et al., 2005). The conclusion from these studies was that risk could be reduced most efficiently if investment in ESMs was part of the strategy adopted[49]. Given the current export orientation of Central European economies – and their strengthening links with (and membership of) the European Union, it would be reasonable to speculate that the extent of correlation with developed markets such as Germany, Italy or France (Lorinc, 1995) would be increasing. The key empirical issue – and the one investigated here – is whether the benefits of CEE – based diversification continue to exist despite the on – going integration.

An example of the heightened interest in ESMs as a whole can be found in Claessens (1995), who noted that World Bank estimates of portfolio flows into developing countries' equities were an estimated $3.5 billion in 1985. By 1993, the figure had increased to $13.2 billion. While the main focus for academics has been on the emerging stock markets in Asia, Africa and the Americas, some academic attention has focused on the gains available when diversifying into the CEE region.

Gilmore and McManus (2002) investigated the short – and long – term behaviour of correlations between developed and CEE region equity price movements. (The CEE markets investigated were namely the Czech Republic, Hungary and Poland). Two developed markets – US and Germany – were used for comparison and daily index data over the time period July 1995 – September 2003 studied. Tests of correlation were used to investigate the extent of any benefits in the

[49] Speidell and Sappenfield (1992) found clear evidence that emerging markets have an important role

short – term, while bivariate and multivariate co – integration tests were employed to examine the long – term benefits. The results showed that the stock markets situated in Central and Eastern Europe were not co – integrated with the US stock market, either as a group or individually, nor in either the short – or long – term. The authors argue that US investors could benefit from the low correlations with the CEE markets both in the short – and long – term, and that continuing economic growth would help to maintain the profitability of these strategies.

A recent paper by Syriopoulos (2004) examined the short and long – run relationships between four major CEE stock markets, (the Czech Republic; Hungary; Poland; and Slovakia) and the developed markets of Germany and the USA. Correlation tests were used to determine the linkage[50] between the short – run along with other sophisticated tests for unit roots and the Johansen error correction procedure. The results showed that the stock markets in the CEE region displayed strong linkages with the developed markets, although the interdependencies between the individual CEE markets appeared to be weak. The Czech Republic, Hungary and Poland exhibited the highest proportion of domestic stock index variance. In addition, the long – run co – movement figures implied that the potential for diversifying risk and attaining superior portfolio returns may be limited for international investors.

Gilmore et al. (2005) studied daily index level prices from July 1995 – September 2003 for three of the most developed Central European equity markets (the Czech Republic, Hungary and Poland); the German and US markets were again used as the developed markets benchmarks. Optimal portfolios were constructed for both German and US investors using four optimisation models based on the mean –

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to play in portfolio diversification.

[50] Strong international linkages between the stock markets would have a positive implication for the CEE region's firms in terms of access to and integration with the world's major capital markets (Syriopoulos, 2004).

variance approach. The certainty equivalence tangency portfolio (CETP)[51]; the minimum variance portfolio (MVP); the Bayes – Stein portfolio (BSP); and a naïve portfolio were modelled. As the returns were considered to be non – normal, the lower partial moment (LPM) was used to calculate the risk. The results suggested (i): that US – based investors should allocate around 20 – 25 per cent to the portfolio consisting of emerging market shares; and (ii) that the Bayes – Stein portfolio performed best out of the sample portfolios regardless of the risk measure used. The LPM results, the mean return was 0.08 per cent and the standard deviation was 0.22 per cent. In contrast, for a US – only portfolio the mean return was -0.11 per cent and the standard deviation was 0.18 per cent. Overall, the MVP generated the worst results.

Patev et al. (2006) examined the short and long – term co – movements of the CEE markets before, during and after the major regional crisis of the late 1995. The impact was examined by looking at the gains from international portfolio diversification (IPD) that could be achieved by US investors in the region. The Granger Causality test and variance decomposition techniques were used to evaluate the extent of short – term integration and the Johansen co – integration test was implemented to analyse the long – run. The data utilised related to the stock markets in: the Czech Republic; Hungary; the Russian Federation; Poland and the US, and covered the time period August 1996 – August 2001. The results indicated that there was an opportunity for IPD – based gains as the CEE markets did not have uniform trends and long – term interrelationships. Overall, the results supported the notion that a US investor can benefit from IPD in the CEE markets in both the short – and long – term.

[51] The CETP assumes that the portfolio's expected returns are best forecasted as an average of the

Turkey has been the focus of a number studies such as Fifield et al. (1999) who argued that it meets the main criteria for ESM status. The authors report that Turkish firms perform best relative to other countries[52] over the period 1991 – 1996, earning a mean weekly return of 1.1 per cent (although it also had the highest degree of variability).

3.6 Emerging Stock Market Hurdles

The literature on emerging markets has placed considerable focus on the risk of investing in emerging markets in general terms from an investors' perspective; (Helliar et al., 1996, 2000) in terms of the political risk (Diamonte et al., 1996); and regarding specific country and industry factors (Serra, 2000). As the literature on the quantitative benefits of investing in CEE markets has developed, so to has the focus on the risk inherent in IPD in the region, as set out.

Köke's (1999) study referred to earlier in terms of the location of CEE investment risk also explores the nature of the practical hazards faced by Western portfolio managers when evaluating securities in CCE emerging stock markets. Almost all of the investors questioned said that liquidity was a very important factor in regards to making their investment decision (although statistical significance for the results on liquidity was not found). The descriptive analysis highlighted issues with the Czech Republic and Russia in relation to perceived managerial quality, improved corporate governance in recent years has played an important role in the reduction of corruption in most of the emerging stock markets. The beneficial effect of such improvements in consistent with evidence in an earlier study by Lorinc (1995)

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historical returns.

[52] The other countries included in this study were Argentina, Chile, Greece, Hong Kong, India, Indonesia, Korea, Malaysia, Mexico, the Philippines, Portugal, South Africa, Singapore, Sri Lanka, Taiwan and Thailand.

who suggested that prospective investors wishing to use the Eastern European markets would have to be prepared to accept a higher degree of risk as an inevitable problem with IPD in the region. An alternative perspective was adopted by Köke and Schröder (2003) who revealed that foreign investors in CEE stocks were mostly restricted by regulation to a few stocks listed in the official markets; overall transaction costs remained high as well, thereby reducing the potential for active portfolio management to make net gains.

Middleton et al. (2007a) provided a detailed analysis of the barriers to CEE investment from an investor's perspective. Two main barriers were identified by the investors taking part in the study. The first was the limited size of the markets, including the relatively small number of firms listed on the CEE stock exchanges, while the second barrier related to the lack of a wide range of sectors in the markets. The interviewees were, however, positive about political risk as the EU accession was thought to have had a positive influence in this regard and had increased the confidence of foreign investors. Several interviewees expressed concern about corruption, however, which was even seen as still having an impact, even in the more developed markets such as the UK and the US. Interestingly, in the context of earlier discussions in this chapter, all the respondents stated that the Russian Federation should be classified individually and not associated with the CEE countries given its idiosyncratic properties; particular problems identified included pervasive corruption and uncertainty about property rights. Overall, currency and political risk were not seen as problematic, given the extent of integration of the CEE countries into the EU; managers were more concerned with liquidity problems and corporate governance issues. This evidence is consistent with an earlier study by Gill and Tropper (1988) which reported that not only is there a greater incidence of thin trading in emerging

than developed markets, but the former are also especially susceptible to currency risk as there are few forward foreign exchange markets and any large gains that could potentially be earned are at risk from adverse movements in the exchange rate (Glen and Jorion, 1993).

The most detailed study of these issues to date, by Mateus (2004), investigated the risk and equity return predictability amongst the 13 EU accession countries in the CEE region. The time period utilised was 1997 – 2002, and global[53] and economic[54] factors used to predict CEE share returns across the region. The highest explanatory power amongst the sample countries featuring in this dissertation was Slovenia (where 19.3 per cent of share price variability was predicted), followed by Hungary and the Czech Republic (18.6 per cent and 18.1 per cent respectively). For models based only on global factors, the highest figure was Romania (at 11.5 per cent). For local factor – based modelling, the strongest results were for Slovenia and the Czech Republic, where 18.6 and 15.9 per cent of variations in equity returns were accurately predicted respectively. Overall, the study found that significant excess market returns were restricted to the markets of Hungary, Poland and Turkey, which the authors suggest reflects a low degree of market liberalisation and capital market integration.

Berglöf and Pajuste (2003) investigated corporate governance in the CEE region and suggest that the main problem is the concentrated control structures and lack of separation of ownership and control found in most of the nations concerned. The authors suggest that this pattern reflects the lack of expertise in professional management in the region, and the unwillingness of owners to relinquish control

[53] The global instrument variables employed included; (i) the lagged world market return; (ii) the lagged 90 – day EU – US Treasury yield spread; (iii) the world dividend yield; and (iv) the 1 – month return on a US Treasury Bill.

[54] The country specific factors used were: (i) lagged local market returns; (ii) lagged changes in local industrial production; (iii) short – term interest rates; (iv) movements in the official exchange rate against the US dollar and; (v) lagged local price – to – book values.

given this systemic weakness; minority shareholders often suffer in such circumstances. The study also asserts that CEE firms are prone to be very secretive about basic details and information, even though regulations were in force that require the disclosures to be made. In contrast, only four years later, the interviewees in Middleton et al. (2007a) indicated that the listing requirements of modern CEE stock markets ensure that a lot of key information is now disclosed to potential investors.

3.7 The CEE Stock Exchanges

Prior to the 1990s, the CEE countries all operated under central plan – based communist regimes and – where stock exchanges had existed – these were shut down by incoming communist governments. However, since the collapse of the totalitarian regimes in the region, the CEE nations have attempted to become more integrated with liberal economies by adopting market – based systems and moving away from the centrally – controlled model. Table 3.3 highlights some of the main characteristics of the stock markets that have developed as these structural changes have take place. From the table, it is clear that the markets are very young in comparison with those in developed economies, with the earliest trading in the region beginning in Turkey in 1983. Despite the growth, the markets still exhibit relatively low liquidity due to their short history and the undeveloped state of the domestic institutional investor sector (Claessens et al., 2003). In this context, it is interesting

Table 3.3

Characteristics of the CEE Stock Markets

Country		***Croatia***	***The Czech Rep***	***Estonia***	***Hungary***	***Poland***
Stock Exchange		Zagreb Stock Exchange	Prague Stock Exchange	Tallinn Stock Exchange	Budapest Stock Exchange	Warsaw Stock Exchange
Year Stock Exchange Started Trading		1991	1993	1995	1990	1991
Main Indices		CROBEX CROBIS	PX 50 PX - GLOB	TALSE	BSE BUMIX	WSE WSE 20
Trading System		OMX X-Stream	SPAD – System for Support of Shares and Bonds Markets	Helsinki Trading System	Multi Market Trading System (MMTS)	WARSET System
Settlement Period		T + 4	UNIVYC – Joint Stock Company Automatic Trades: T + 3 Block Trades: T + 0 - T + 15	Automatic Trades: T + 3 Negotiated: T + 1 – T + 6	KELER – Central Depositary and Clearing House T + 3	Delivery Versus Payment (DVP) basis T + 3
Supervisory Bodies		Croatian Agency for Supervision of Financial Services (CROSEC)	Czech Securities Commission (CSC)	Financial Supervisory Authority (FSA)	Supervisory Board	Supervisory Board
Listed domestic companies	**2003**	66	63	14	49	203
	2004	145	54	13	47	225
	2005	145	36	15	44	248
	2006	183	29	16	41	267
Turnover Ratio (%)	**2003**	0.7	6.0	1.6	4.6	2.2
	2004	5.9	78.5	17.5	59.9	33.1
	2005	6.6	120.7	51.5	79.2	37.3
	2006	9.8	77.5	27.5	88.2	46.8

Table 3.3 (cont.)

Country		*Romania*	*The Russian Fed.*	*Slovenia*	*Turkey*
Stock Exchange		Bucharest Stock Exchange	Russian Trading System	Stock Exchange	Istanbul Stock Exchange
Year Stock Exchange Started Trading		1995	1995		1983
Main Indices		BET BET-C	RTS	LJSE SBI 20	ISE
Trading System		HORIZON	RTS Electronic Trading System	Ljubljana Stock Exchange Trading System (BTS)	N/A
Settlement Period		National Bank of Romania T + 3.	T + 3 using RTS Settlement Chamber	Central Securities and Clearing Corporation (KDD) T + 2 Using DVP basis its T + 2. (All automatic)	N/A
Supervisory Bodies		Romanian National Securities Commission (CNVM)	Central Bank of Russia.	The Association of Supervisory Boards' Members	Capital Market Boards
Listed domestic companies	**2003**	4,484	214	32	284
	2004	4,030	215	140	296
	2005	3,747	296	116	302
	2006	2,478	309	100	314
Turnover Ratio (%)	**2003**	0.5	3.0	1.4	28.5
	2004	11.6	53.0	14.6	182.3
	2005	28.8	39.0	9.1	153.9
	2006	16.9	65.7	10.3	143.0

Note: The table above highlights a number of characteristics regarding the stock markets situated in the CEE region. The listed domestic companies and turnover ratio data were taken from "World Development Indicators" (Various editions, 2004 – 2007).

that the majority of the exchanges listed in Table 3.3 had secondary exchanges operating as early as 2004. The CEE markets are still relatively new, but Claessens et al. (2003) claimed that they have been able to bypass many development stages by using modern trading systems from their inception and other infrastructural advances which would aid progress and help to establish links with the mature markets. Many

of these technological leaps are reflected in Table 3.3; for example, the Croatian Stock Exchange in Zagreb uses OMX X – Stream, a trading system provided by the Swedish OMX thus avoiding many of the costs associated with technological learning. The new trading system was adopted to help remove the technical obstacles for further market development and to give customers reliable and cheap access to modern financial instruments and products. Similarly, Estonia uses the Helsinki[55] Trading System, imported from Finland and is a member of the HEX group; this type of consolidation could be seen as beneficial in terms of access to capital as the group allows various equities to be traded on any member market. More generally, Table 3.3 reveals that a variety of differences still persist across the region in terms of trading systems and regulatory authorities. However, if recent trends (see Arnold, 2006) for international integration (along the lines of the HEX and Euronext models) in markets continue, many of these differences will disappear.

Table 3.3 also reflects advancements in technology that have led to the settlement process improving across the region. For instance, the Prague Stock Exchange employs a system called UNIVYC which aids the process of settling trades; trades can be processed as early as T + 0 and as late as T + 15. In Slovenia, there are two methods which can be used to settle trades, the "KDD" and "DVP" bases; the latter of which is also employed in Poland. However, Helliar et al. (2000) found that share settlement systems continued to represent a trading barrier in some emerging markets as the extant systems involved millions of pieces of paper being circulated and the formal record of settlement information prone to losses.

[55] HEX is the Finnish stock exchange group that operates the stock exchanges in Estonia, Finland and Latvia. In April 2001, HEX acquired 61.6 per cent of the Tallinn Stock Exchange (Claessens et al., 2003). In July 2001, Latvia and Lithuania held talks with HEX over the possible acquisition of the Baltic nations' exchanges by HEX (Mateus, 2004).

Each stock market has a supervisory body or board to oversee the market and ensure that investors' interests are protected and financial crime is reduced. Although Table 3.3 highlights variation in the title of the bodies, in each case the emergence of the organisation represented a move by developing countries to foster regulatory systems that resemble their developed counterpart.

Table 3.3 also documents the number of companies listed on each stock exchange in the CEE region over the period 2003 – 2006. This data reveals the small number of companies listed on several of the exchanges. Whilst Romania had by far the largest number of companies listed in the sample (2,478 in 2006) – and the Russian Federation and Turkey also had large numbers of listed firms – the Czech Republic, Estonia and Hungary all had less than 50 members at the end of the period. In most cases, the number of listed firms grew between 2004 and 2006, but in three markets – the Czech Republic, Hungary and Romania – the number of companies fell over the period. The decreases may reflect the fact that some privatisations were abandoned (Claessens et al., 2003) or simply that improvements in market transparency and liquidity led to a spate of mergers and consolidations.

Finally, Table 3.3 also highlights turnover ratios[56]; other things being equal, a small, liquid market should have a high turnover ratio (Arnold, 2006). Visual inspection of the turnover ratios indicates a range of values (and changes) across the region. The lowest ratio in each year was recorded by Croatia, which failed to reach the 10 per cent level at any point between 2003 and 2006. While all markets experienced growth (often substantial) in the ratio, the Istanbul exchange consistently scored the highest values, ranging from 28.9 per cent to 182.3 per cent. Once again,

[56] This is a measure of the number of times a company's inventory is replaced over a certain time period.

the picture is of a region in which markets are developing rapidly, but wherein significant variability in structure and investment environment persist.

3.8 Conclusion

This chapter has provided a review of the aspects and characteristics of the CEE markets most relevant to the empirical analysis which follows. In particular, the structures, advantages and risks pertaining to the CEE region's main stock exchanges have been outlined and discussed. What the chapter indicates most clearly is that – although a general trend of closer integration is evident – circumstances and developments in each nation vary in substantive ways. There is, therefore, a need for a study of equity pricing in the region that is both up-to-date and comprehensive in terms of coverage. The remainder of this dissertation endeavours to accomplish this.

Chapter Four

The Predictive Ability and Profitability of Technical Trading Rules

4.1 Introduction

This chapter presents the results from the tests of the weak form EMH which were conducted using share return data for a sample of nine CEE emerging market indices. In particular, both the filter and moving average strategies are applied to the data set in order to establish whether the strategies utilised are able to exploit any trends that may be present in the share prices changes in order to yield a profit. The strategies are conducted in both sterling and in prices denominated in the local currency.

In this respect**,** a practical approach is adopted. The filter and moving average strategies are examined from the perspective of a UK investor to investigate whether these active strategies can outperform the corresponding passive strategy. If this is the case, then the hypothesis that the markets are efficient in the weak form is rejected, as the two trading rules are designed to exploit any trends that may exist in the data.

The remainder of this chapter is organised as follows. Section 4.2 describes the data used in the study while section 4.3 outlines the descriptive statistics of each of the nine CEE markets. Section 4.4 comments on the trading methods used and details particular filter and moving average rules employed. Sections 4.5 and 4.6 present the results of the filter and moving average rules, respectively. Finally, section 4.7 offers a conclusion to the chapter.

4.2 Data

This dissertation employs 353 shares that are traded on the equity markets of Croatia (CRO), the Czech Republic (CZE), Estonia (EST), Hungary (HUN), Poland (POL), Romania (ROM), the Russian Federation (RUS), Slovenia (SLO) and Turkey

(TUR). Daily closing share prices for the selection of shares were obtained from Datastream over an 11-year time period from 1 January 1997 to 31 December 2007 for the nine CEE emerging markets. Each share had to meet certain criteria in order to qualify for inclusion in the study. In particular, the shares had to have been traded over the sample period in question and the share information had to be available from Datastream. Some company data was omitted from the study because share prices were not available over the full sample period. Other countries such as Bulgaria, Latvia, Lithuania and the Ukraine were considered but not included in the study as daily closing share price information was not available for the whole time period.

After the criteria were employed, a final sample of 353 companies was identified: Croatia (4 shares), the Czech Republic (34), Estonia (5), Hungary (28), Poland (27), Romania (7), the Russian Federation (59), Slovenia (2) and Turkey (187). The selection of countries should be of interest as in May 2004 five of the nine countries that joined the EU were from the Central and Eastern Europe region (the Czech Republic, Estonia, Hungary, Poland and Slovenia). Romania was admitted to the EU in January 2007, and two other CEE countries are negotiating future membership (Croatia and Turkey). The Russian Federation is the only country that has not been in negotiations to join the EU. It will be interesting to see which countries are able to exploit the trading rules, either the countries that joined the EU in 2004, those that have recently joined or the countries that have yet to join.

4.3 Descriptive Statistics

A number of descriptive statistics for the daily returns for the sample of 353 companies were calculated over the 11-year time period, 1 January 1997 – 31 December 2007. These statistics are shown in Table 4.1 (see Table 4.1A In Appendix

4.1 for descriptive statistics calculated using local currency returns). All of the returns were collected in local currency and then converted to UK pounds sterling. This conversion is important as it allows a comparison of the returns between the different markets, as well as adjusting for the differences in inflation rates. Finally, it allows the study to adopt the perspective of a UK investor. The returns for each company were calculated according to the formula:

$$R_{it} = \text{Ln} [(P_{it} / P_{it-1}) (X_{t-1}/X_t)] \qquad [3.1]$$

where R_{it} is the return on share *i* for day *t*, P_{it} is the price of this share in the same period and X_t is the exchange rate for the period, which was obtained from Datastream. Finally, Ln represents the natural logarithm.

Descriptive statistics such as the mean (MEAN), standard deviation (STDEV), the minimum (MIN) and the maximum (MAX) return were estimated for each country. In addition, skewness (SKEW) and kurtosis (KURT), which measure the shape of the return distribution, were estimated. The skewness and kurtosis statistics help to determine whether the assumptions of statistical tests are satisfied by the data. Finally, tests of normality were calculated using the Anderson – Darling (AD) test and the Kolmogorov – Smirnov (KS) test.

A number of interesting points emerge from a visual inspection of the descriptive statistics which are shown in Table 4.1. First, the mean daily returns for all nine of the CEE markets were positive, with returns ranging from 0.0026 per cent (the Russian Federation) and 0.0415 per cent (Estonia). Second, the average figures were similar in most markets; other than the relatively low Russian figure, the means ranged from 0.017 (Turkey) to 0.074 (Slovenia).

Table 4.1
Descriptive Statistics for Daily Returns from nine Central and Eastern European Stock Markets over 1997 – 2007: Sterling Currency

	MEAN	STDEV	MIN	MAX	SKEW	KURT	AD	KS
CRO	0.000318	0.017662	-0.143393	0.155514	0.359*	10.693*	68.431*	0.096*
CZE	0.000291	0.008428	-0.084033	0.074523	-0.395*	9.355*	19.714*	0.054*
EST	0.000415	0.021180	-0.183347	0.169970	-0.404*	10.048*	59.450*	0.096*
HUN	0.000311	0.014443	-0.123130	0.088674	-0.945*	8.664*	47.387*	0.084*
POL	0.000224	0.015436	-0.144816	0.106942	-0.691*	6.702*	20.906*	0.055*
ROM	0.000283	0.025783	-0.352047	0.335640	-0.366*	30.122*	71.445*	0.095*
RUS	0.000026	0.025465	-0.576213	0.343659	-4.778*	148.495*	267.704*	0.194*
SLO	0.000744	0.013534	-0.110385	0.100705	0.176*	8.134*	35.235*	0.067*
TUR	0.000170	0.028421	-0.328485	0.233531	-0.938*	13.431*	71.667*	0.106*
AVG	0.000309	0.018928	-0.227317	0.178795	-0.887	27.294	73.549	0.094

Note: The table details descriptive statistics for the nine sample countries over the 11 – year period, 1997 – 2007. The MEAN is the equally weighted average of the daily observations over the 11 – year time period. STDEV, MIN, MAX represent the standard deviation, minimum and maximum daily returns, respectively. SKEW is the Kendall – Stuart measure of skewness and KURT is the Kendall – Stuart measure of kurtosis. The table also shows the results from the Anderson – Darling (AD) and Kolmogorov – Smirnov (KS) tests for normality. * denotes significance at the 5 per cent level. The table based on returns denominated in sterling currency terms.

Third, the poor average return performance of the Russian Federation was associated with a very high level of risk. The standard deviation of returns for the Russian Federation is 2.5465 per cent, higher than the average standard deviation of 1.8928. Also, the overall average return of the companies in the CEE region is 0.0309 per cent, and 4 countries (Croatia, Estonia, Hungary and Slovenia) performed better than the average over the 11 – year time period.

Fourth, the CCE regional stock markets returns are highly volatile over the time period 1997 – 2007. The Czech Republic exhibited the lowest risk amongst the CCE stock markets with a standard deviation of 0.8428 per cent, while Turkey recorded the highest level of risk with a standard deviation of 2.8421 per cent. The observation that these markets are very volatile is further confirmed by the MIN, MAX, SKEW and KURT statistics. For example, the spread between the minimum and maximum return is quite large when compared to the average. The highest spread is recorded by the Russian Federation of -0.91987; this could imply that the profitability of the will either be very high or very low. In contrast, the lowest spread of -0.15856 was recorded for the Czech Republic.

Fifth, portfolio theory implies that higher risk is linked with higher returns. However, Table 4.1 shows that of the four CEE markets (Estonia, the Russian Federation, Romania and Turkey) that have standard deviations higher than the average, all but Estonia are amongst the four markets with the lowest average returns. Sixth, returns for seven of the nine markets (the Czech Republic, Estonia, Hungary, Poland, Romania, the Russian Federation and Turkey) displayed negative skewness which is significant at the 5 per cent level. In contrast, the remaining two markets (Croatia and Slovenia) showed positive skewness which is significant at the 5 per cent level which implies that the return distribution of shares traded on these markets have

a higher probability of earning positive returns. Seventh, the kurtosis statistics are all positive and significant at the 5 per level. This further confirms the findings of the skewness statistics, in the sense that the markets are not well approximated by a normal distribution. The Russian Federation recorded the highest kurtosis statistic at 148.495 while Poland had the lowest statistic at 6.702. From the perspective of a risk averse investor, investment in the CEE region may appear to be unattractive as the distributions would have a tail consisting of negative values.

Finally, the Anderson – Darling and Kolmogorov – Smirnov tests were performed to test the normality of the returns data. Both of these tests were significant at the five per cent level, confirming the CCE markets returns do not conform to a normal distribution. The trading strategies employed in the study do not make any assumptions about distributional properties, thus allowing the researcher to implement these strategies on the underlying dataset.

4.4 Trading Rule Method

This dissertation examines the potential profitability and predictive power of two of the most popular and simplest technical trading rules, the filter and the moving average rule. While a number of studies have focused on trading rules such as the filter rule and moving average rule, there is little evidence which focuses on the usage of both these technical trading rules using data for the CCE region. These rules are chosen to facilitate a comparison with the results from previous studies on the profitability of trading rules (Fama and Blume, 1966; Brock et al., 1992).

The first trading rule investigated is the filter rule. According to the filter rule, buy (sell) signals are generated when the share price rises (falls) by x per cent from the previous low (high). When good news enters the market the share price will rise

and the investor would recognise the opportunity to make a profit. If the price goes higher than expected, the investor will benefit from abnormal profits. In contrast, if the price falls below expectations then the investor would have to sell to minimise their losses. Therefore, this trading rule is non parametric and the rule assumes that the market is not efficient and that prices do not impact on the share price immediately, therefore allowing investors to prosper.

In this present study, twenty different filters which range from 0.5 to 20 per cent were implemented[57]. The choice of filter rules was determined by their use in previous studies. However, only the smaller rules are examined here as larger filters (of 20 per cent or more) tend to perform poorly when compared to smaller-sized filters. Other studies which have tested the filter rule have found that medium-sized filters tend to be profitable (Hunter, 1998). Overall, the number of filters examined is comprehensive and facilitates an examination of those filters which are likely to be profitable in certain markets and economic conditions.

The second technical trading rule examined in this dissertation is the moving average rule. When the short – run moving average is greater (less) than the long – run moving average, a buy (sell) action is taken. This trading rule helps to show the direction and the trend of the share price. Also, it helps to smooth out the share price fluctuations which may be insignificant. The moving average includes two components: a short run and a long run period. The moving average helps to smooth out the short run market movements and then identifies trends in the long run. In general, the rule produces a buy (sell) signal when the short run moving average share price is above (below) the long run moving average. In addition, a bandwidth can be added into this rule. With the introduction of the bandwidth, buy (sell) signals are

only generated if the short run moving average is above (below) the long run moving average by an amount which is larger than the bandwidth. The bandwidth can be useful as it can help to eliminate "whiplash" signals which can occur if the short and long run moving averages are close together.

In this study, 10 moving average rules are tested from Brock et al. (1992): (1, 50, 0), (1, 50, 1), (1, 150, 0), (1, 150, 1), (5, 150, 0), (5, 150, 1), (1, 200, 0), (1, 200, 1), (2, 200, 0) and (1, 200, 1). In addition, two situations are utilised from the perspective of a UK investor. First, the filter rule is examined whereby investors are allowed to take both short and long positions (short selling) and second, they are examined assuming that investors can assume long positions only. The decision was made to test both of these strategies as some stocks markets in the sample do not allow short selling (Croatia, Estonia and Slovenia). In addition, it is interesting to see how the profitability differs between the two strategies; Sweeney (1988, 1990) argued that filter rules are more profitable if they allow long positions only. Finally, as both trading rules make no assumptions about the distribution of the data, their usage is appropriate for examining the extent of weak form efficiency for the selection of CEE markets studied.

A number of assumptions underpin the trading rules examined in this dissertation. First, it is assumed that the investor starts off with a buy transaction on the first day. Therefore, when the short - long strategy is used, the investor starts to trade on the market and does not change his position until a sell signal is generated. After the sell signal, the investor is assumed to sell the share and go short until the next buy signal is generated. However, when the long – only strategy is used, it is assumed that the investor will hold the share until the next buy signal is generated.

[57] The filters represented in this study are 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 6.0, 7.0, 8.0, 9,0,

The investor will liquidate his/her position when a sell signal is generated. Afterwards, the profits from the various trading rules are calculated and compared to the buy-and-hold strategy.

Another distinct feature of this study is that transaction cost data are taken into account. This data were extremely difficult to obtain. Various sources, such as articles and books were consulted; the Emerging Stock Markets Factbook (2000) was used to obtain transaction cost data for the Czech Republic (0.4379 per cent), Hungary (0.4518 per cent) and Turkey (0.33 per cent). Transaction costs for the other sample markets were obtained from a senior advisor in a leading bank which trades in all of the markets included in this dissertation. Upon asking for a range of costs for the markets, this anonymous source quoted "between 0.2 to 0.4 per cent". Therefore, the value of 0.2 per cent was used for the markets in Croatia, Estonia, Poland, Romania, the Russian Federation and Slovenia. He stated that the range was due to the fact that the bank was not a full member of all the stock exchanges; therefore, third parties were used to initiate the trades, with the bank being charged a small fee by the third party and taking commission[58]. The results discussed above have, however, taken account of the transaction costs.

4.5 Filter Rule Results

The results for the 20 different filter strategies in the nine different Central and Eastern European countries are discussed in this section. The filter rule results are presented in Tables 4.2 and 4.3 for the short-long and long-only strategy, respectively,

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10.0, 12.0, 14.0, 16.0, 18.0 and 20.0 per cent.

[58] On further discussion with the senior adviser, he disclosed his trading strategies. For example, when evaluating strategies to use in developed markets, benchmarking was used. When looking into the CCE region, the skewness of each industry in each country was looked at in assessing the best way to structure a portfolio. Also, the individual stated that the Russian Federation should be classified separately from the CEE region due to the high amount of thin trading.

in sterling. The rows in the table show the country (for example, CRO is Croatia), the number of trades initiated by each filter strategy (NoT), the filter rule profit (Net Ret.) and the return for the corresponding buy-and-hold strategy (B & H). The final row documents the difference in profits between the filter rule and the buy-and-hold strategy (Diff.). In addition, two further tables are provided to give a comprehensive picture of the profitability and predictive ability of filter rules in the CEE markets. In particular, Tables 4.2A and 4.3A (in Appendix 4.1) show results for both filter strategies in local currency terms.

A visual inspection of Table 4.2 reveals that the ability of filter rules to predict changes in emerging market indices is limited; in general, the performance of the filter rule is inferior when compared to the passive buy-and-hold strategy. Specifically, out of the 180 filters, only 45 filters are successful[59]. Also, the performance of the rules varies between the different markets considered. Filter rules ranging in size from 0.5 – 4.0 per cent are successful on only one occasion (RUS). However, as the filter size increases to 4.5 – 5.0 and 6.0 – 16.0 per cent, the number of successful rules rises to two (CZE and RUS) and three (CZE, RUS and TUR), respectively. Finally, the largest filters tested in this dissertation (18.0 and 20.0 per cent) outperformed the buy-and-hold strategy on four occasions (CZE, POL, RUS and TUR). The best trading strategy after transaction costs was the one per cent filter; this rule generated a profit of 4798.6 per cent. The second and third most profitable filters were the 4.5 and 12.0 per cent filters which generated a profit of 903.2 and 879.6 per cent, respectively. These results are surprising as the smaller filters generate the highest number of and yet they are very profitable[60].

[59] In terms of local currency when using the short selling strategy, out of the 180 filters tested, only 8 of the rules outperformed the buy-and-hold strategy.
[60] Only the filters ranging from 1.5 to 20 per cent are profitable on one occasion.

In relation to countries, out of the nine markets studied, only four have a rule which is profitable. For example, the Russian Federation performs exceptionally well when compared to the other nine markets, indicating that it is least efficient in the weak form[61]; all of the rules outperformed the buy-and-hold strategy by a large amount (although the Czech Republic yielded net profits for all filters of 4 per cent and above). The 1 per cent filter produced by far the highest net profit for the Russian Federation, with a figure of 4654.4 per cent resulting; this figure was not representative, however. The other filters generated net profits for RUS ranging from the 588.4 to 759 per cent.

In Turkey, only half of the filter rules outperformed the buy-and-hold strategy; these ranged in size from 10 – 20 per cent[62]. In addition, the most profitable filter was the 18 per cent filter which produced a profit of 509.3 per cent. This was followed by the 14 and 20 per cent filters which generated excess returns of 499.8 and 493.7 per cent, respectively. The Polish market had only two profitable filter rules; the 18 and the 20 per cent rules generated a superior return of 326.7 and 307.0 per cent, respectively.

Excluding the Russian Federation, all the filters in all the markets that are under 3.5 per cent were unprofitable. This is consistent with studies such as Huang (1995) who found that filters of less than 4 per cent were unprofitable in Asian markets.

[61] Surprisingly, the Russian Federation in local terms proves to be unprofitable when all the filters are implemented. The Czech Republic outperforms all of the other countries.
[62] All of the filter rules are unprofitable in terms of the local currency.

Table 4.2
Results for the Filter Trading Strategy with Short Selling: Sterling Prices

Filter (%)	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
CRO										
NoT	1893.5	1431.5	1147.5	971.5	829.5	771.5	626.0	557.0	492.0	436.0
Net Ret.	-562.3	-582.4	-505.1	-508.0	-542.4	-477.5	-489.3	-502.5	-418.7	-394.8
B & H	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8
Diff.	-714.1	-734.2	-656.9	-659.9	-694.3	-629.3	-641.1	-654.4	-570.6	-546.7
CZE										
NoT	1523.3	998.2	763.3	595.2	496.6	434.9	379.2	335.2	298.0	262.4
Net Ret.	-161.2	65.7	134.4	231.9	260.7	281.8	299.1	326.8	355.0	355.7
B & H	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4
Diff.	-469.7	-242.7	-174.1	-76.6	-47.7	-26.6	-9.3	18.4	46.6	47.3
EST										
NoT	2008.8	1573.6	1334.4	1130.4	972.0	836.0	743.2	663.2	600.8	547.2
Net Ret.	-1129.3	-1176.8	-1221.5	-1262.8	-1182.5	-1062.1	-1023.1	-940.6	-905.1	-901.1
B & H	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0
Diff.	-1619.3	-1666.8	-1711.5	-1752.8	-1672.5	-1552.1	-1513.1	-1430.5	-1395.1	-1391.1
HUN										
NoT	1996.4	1559.5	1265.5	1062.4	903.4	773.5	678.9	599.3	533.1	479.4
Net Ret.	-712.1	-572.7	-458.8	-468.1	-420.4	-375.8	-353.8	-315.9	-273.9	-297.9
B & H	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9
Diff.	-1044.0	-904.6	-790.8	-800.0	-752.3	-707.7	-685.7	-647.8	-605.8	-629.8
POL										
NoT	2226.7	1819.2	1525.5	1310.8	1141.3	1005.0	892.9	795.9	717.4	647.7
Net Ret.	-142.9	-136.6	-128.9	-118.4	-124.9	-134.6	-144.5	-130.6	-131.6	-115.6
B & H	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
Diff.	-437.3	-430.9	-423.2	-412.7	-419.2	-428.9	-438.8	-424.9	-425.9	-409.9

Note: The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the short selling filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling currency. All returns are expressed in percentages.

Table 4.2 (continued)
Results for the Filter Trading Strategy with Short Selling: Sterling Prices

	6.0	7.0	8.0	9.0	10.0	12.0	14.0	16.0	18.0	20.0
CRO										
NoT	361.0	301.0	252.0	217.0	191.0	130.5	107.0	89.0	71.5	65.5
Net Ret.	-339.3	-261.5	-201.5	-184.0	-169.9	31.6	29.6	19.5	-6.2	-93.6
B & H	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8
Diff.	-491.1	-413.4	-353.3	-335.8	-321.7	-120.2	-122.2	-132.3	-158.0	-245.5
CZE										
NoT	211.5	179.4	156.1	136.0	118.5	94.4	77.1	65.1	55.2	47.8
Net Ret.	362.5	345.3	342.6	343.4	346.1	318.1	340.3	334.4	363.0	492.9
B & H	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4
Diff.	54.1	36.9	34.2	35.0	37.7	9.7	31.9	26.0	54.5	184.5
EST										
NoT	446.4	383.2	336.8	299.6	266.8	222.8	167.2	123.2	101.6	85.2
Net Ret.	-713.6	-650.6	-582.5	-497.0	-447.9	-281.6	-48.2	120.1	126.7	117.9
B & H	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0
Diff.	-1203.6	-1140.6	-1072.4	-986.9	-937.9	-771.6	-538.2	-369.8	-363.2	-372.1
HUN										
NoT	391.4	326.5	282.1	249.1	223.4	179.4	146.2	121.3	101.3	86.4
Net Ret.	-215.0	-150.9	-136.5	-143.1	-138.0	-193.5	-142.2	-109.3	-54.0	-58.4
B & H	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9
Diff.	-546.9	-482.9	-468.4	-475.1	-469.9	-525.4	-474.2	-441.3	-385.9	-390.3
POL										
NoT	537.1	445.6	380.5	326.3	282.1	213.9	169.6	137.6	110.9	94.8
Net Ret.	-89.2	-50.7	-17.3	32.3	49.9	129.0	185.8	253.2	326.7	307.0
B & H	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
Diff.	-383.6	-345.0	-311.6	-262.0	-244.4	-165.3	-108.5	-41.1	32.4	12.6

Note: The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the short selling filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling currency. All returns are expressed in percentages.

Table 4.2 (continued)
Results for the Filter Trading Strategy with Short Selling: Sterling Prices

	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
ROM										
NoT	2015.7	1620.3	1411.1	1263.1	1117.4	1008.3	915.7	832.7	756.3	693.7
Net Ret.	-495.4	-363.4	-428.7	-441.5	-453.4	-441.0	-471.9	-366.5	-326.9	-327.0
B & H	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0
Diff.	-1625.4	-1493.4	-1558.7	-1571.5	-1583.4	-1571.0	-1601.8	-1496.4	-1456.9	-1457.0
RUS										
NoT	1510.6	995.4	778.1	659.0	568.2	497.6	442.6	397.5	366.0	339.9
Net Ret.	745.3	4798.6	797.3	754.9	732.7	791.7	848.2	859.6	903.2	817.3
B & H	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2
Diff.	601.1	4654.4	653.1	610.7	588.4	647.4	704.0	715.4	759.0	673.1
SLO										
NoT	1900.0	1360.0	1000.0	760.0	614.0	478.0	399.0	325.0	276.0	243.0
Net Ret.	-239.6	-128.0	-55.4	25.8	13.1	65.5	49.1	106.8	122.5	86.7
B & H	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0
Diff.	-1026.6	-915.0	-842.4	-761.2	-773.9	-721.4	-737.9	-680.1	-664.5	-700.3
TUR										
NoT	2345.2	1987.6	1738.2	1530.1	1349.1	1201.6	1075.6	965.6	867.9	785.7
Net Ret.	-532.9	-374.2	-283.5	-194.4	-97.5	-49.1	0.3	59.3	133.3	170.8
B & H	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8
Diff.	-768.7	-610.0	-519.3	-430.2	-333.3	-284.9	-235.5	-176.5	-102.5	-65.0

Note: The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the short selling filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling currency. All returns are expressed in percentages.

Table 4.2 (continued)
Results for the Filter Trading Strategy with Short Selling: Sterling Prices

	6.0	7.0	8.0	9.0	10.0	12.0	14.0	16.0	18.0	20.0
ROM										
NoT	594.0	514.6	440.9	385.1	340.6	274.9	220.0	174.6	144.9	125.7
Net Ret.	-299.8	-253.3	-126.6	-46.5	17.3	144.3	274.3	438.2	503.0	548.5
B & H	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0
Diff.	-1429.8	-1383.2	-1256.6	-1176.5	-1112.7	-985.7	-855.6	-691.8	-626.9	-581.5
RUS										
NoT	287.4	252.0	224.5	201.2	181.3	150.9	130.7	114.2	103.2	92.1
Net Ret.	841.8	801.8	815.4	820.2	846.2	879.6	874.5	792.8	774.2	748.9
B & H	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2
Diff.	697.6	657.6	671.2	676.0	702.0	735.4	730.3	648.6	630.0	604.6
SLO										
NoT	191.0	150.0	118.0	92.0	74.0	56.0	44.0	36.0	32.0	24.0
Net Ret.	94.0	117.6	200.7	219.6	259.0	243.0	225.7	216.5	151.3	193.4
B & H	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0
Diff.	-693.0	-669.3	-586.3	-567.4	-528.0	-543.9	-561.2	-570.5	-635.7	-593.6
TUR										
NoT	652.8	551.4	474.6	411.1	357.3	281.3	227.3	188.8	157.2	133.8
Net Ret.	239.6	301.4	333.4	397.8	440.0	482.6	499.8	496.9	509.3	493.1
B & H	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8
Diff.	3.8	65.6	97.6	162.0	204.2	246.8	264.0	261.1	273.5	257.3

Note: The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the short selling filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling currency. All returns are expressed in percentages.

Table 4.3
Results for the Long – Only Filter Trading Strategy: Sterling Prices

	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
CRO										
NoT	947.5	716.0	574.0	486.0	415.0	356.0	313.0	278.5	246.0	218.0
Net Ret.	-238.1	-247.5	-209.3	-207.2	-223.7	-198.6	-203.0	-213.7	-173.0	-157.1
B & H	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8
Diff.	-389.9	-399.3	-361.1	-359.0	-375.5	-350.4	-354.8	-365.6	-324.9	-309.0
CZE										
NoT	761.6	499.1	381.6	297.6	248.4	217.6	189.8	167.8	149.2	131.4
Net Ret.	-31.4	83.4	114.3	167.7	173.9	186.2	194.3	205.0	221.7	221.7
B & H	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4
Diff.	-339.8	-225.3	-194.2	-140.7	-134.5	-122.3	-114.1	-103.4	-86.7	-86.7
EST										
NoT	1004.4	786.8	667.2	565.2	486.0	418.0	371.6	331.6	300.4	273.6
Net Ret.	-504.9	-525.5	-547.5	-565.6	-523.1	-455.5	-434.7	-388.9	-368.5	-370.0
B B & H	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0
Diff.	-994.8	-1015.4	-1037.4	-1055.6	-1013.1	-945.5	-924.7	-878.9	-858.5	-859.9
HUN										
NoT	998.6	780.1	633.1	531.4	451.9	386.9	339.6	299.8	266.7	239.9
Net Ret.	-297.5	-233.1	-198.2	-199.9	-180.7	-134.4	-113.9	-96.2	-80.0	-80.6
B & H	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9
Diff.	-629.5	-565.0	-530.1	-531.8	-512.6	-466.4	-445.8	-428.2	-411.9	-412.5
POL										
NoT	1113.6	909.8	762.9	655.6	570.8	502.7	446.6	398.1	358.9	324.1
Net Ret.	-22.1	-19.5	-14.9	-10.5	-13.0	-17.6	-19.3	-11.4	-12.6	-4.6
B & H	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
Diff.	-316.4	-313.8	-309.2	-304.8	-307.4	-311.9	-313.6	-305.7	-306.9	-298.9

Note: The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the long – only filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling currency. All returns are expressed in percentages.

Table 4.3 (continued)
Results for the Long – Only Filter Trading Strategy: Sterling Prices

	6.0	7.0	8.0	9.0	10.0	12.0	14.0	16.0	18.0	20.0
CRO										
NoT	180.5	150.5	126.0	108.5	95.5	65.5	54.0	45.0	36.0	33.0
Net Ret.	-119.4	-79.6	-45.3	-37.4	-32.8	74.2	75.2	45.1	5.1	-62.7
B & H	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8
Diff.	-271.3	-231.5	-197.1	-189.2	-184.6	-77.6	-76.6	-106.8	-146.7	-214.6
CZE										
NoT	105.9	89.8	78.2	68.2	59.4	47.3	38.7	32.7	27.7	24.0
Net Ret.	240.5	234.7	239.4	241.0	239.1	222.4	211.4	225.5	264.5	401.3
B & H	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4
Diff.	-68.0	-73.8	-69.0	-67.4	-69.3	-86.0	-97.0	-82.7	-43.9	92.9
EST										
NoT	223.2	191.6	168.4	150.0	133.6	111.6	84.0	62.0	51.2	43.2
Net Ret.	-283.9	-249.6	-223.3	-203.2	-172.4	-141.1	-6.2	80.3	92.7	88.3
B & H	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0
Diff.	-773.9	-739.6	-713.2	-693.2	-662.4	-631.1	-496.2	-409.7	-397.2	-401.7
HUN										
NoT	195.9	163.5	141.4	124.8	111.9	89.9	73.4	61.0	51.1	43.6
Net Ret.	-33.1	-25.3	-15.3	-17.6	-15.3	-35.3	-10.8	8.6	39.0	31.4
B & H	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9
Diff.	-365.1	-357.2	-347.3	-349.5	-347.3	-367.2	-342.7	-323.3	-292.9	-300.5
POL										
NoT	268.8	223.1	190.6	163.5	141.4	107.5	85.3	69.3	55.9	47.9
Net Ret.	12.2	30.7	48.1	73.9	85.5	121.8	147.9	197.9	245.8	236.9
B & H	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
Diff.	-282.1	-263.6	-246.2	-220.4	-208.8	-172.5	-146.4	-96.5	-48.5	-57.4

Note: The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the long – only filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling currency. All returns are expressed in percentages.

Table 4.3 (continued)
Results for the Long – Only Filter Trading Strategy: Sterling Prices

	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
ROM										
NoT	1008.9	811.1	706.6	632.6	559.7	504.3	458.0	412.0	378.3	347.1
Net Ret.	-183.4	-131.0	-160.5	-167.5	-171.7	-167.1	-165.9	-110.8	-93.3	-87.2
B & H	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0
Diff.	-1313.4	-1261.0	-1290.5	-1297.5	-1301.7	-1297.1	-1295.9	-1240.8	-1223.3	-1217.1
RUS										
NoT	755.5	497.9	389.2	329.7	284.4	249.1	221.6	199.0	183.3	170.2
Net Ret.	329.7	4338.9	353.0	336.5	334.2	318.6	379.1	366.9	371.8	336.5
B & H	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2
Diff.	185.5	4194.7	208.7	192.2	190.0	174.4	234.8	222.6	227.6	192.2
SLO										
NoT	950.0	680.0	500.0	380.0	307.0	239.0	200.0	163.0	139.0	122.0
Net Ret.	-7.9	49.8	84.5	126.5	121.0	150.0	140.3	174.1	181.7	162.5
B & H	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0
Diff.	-794.9	-737.2	-702.5	-660.4	-665.9	-637.0	-646.7	-612.9	-605.3	-624.4
TUR										
NoT	1173.3	994.4	869.6	765.5	674.9	601.1	538.1	483.0	434.2	393.1
Net Ret.	-248.3	-166.9	-119.4	-73.4	-27.2	-1.9	22.0	51.9	86.2	105.4
B & H	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8
Diff.	-484.1	-402.7	-355.2	-309.2	-263.0	-237.7	-213.8	-183.9	-149.6	-130.4

Note: The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the long – only filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling currency. All returns are expressed in percentages.

Table 4.3 (continued)
Results for the Long – Only Filter Trading Strategy: Sterling Prices

	6.0	7.0	8.0	9.0	10.0	12.0	14.0	16.0	18.0	20.0
ROM										
NoT	297.4	257.7	220.9	192.9	170.6	137.7	110.3	87.4	72.6	62.9
Net Ret.	-72.7	-43.8	26.3	62.3	97.7	166.9	282.3	372.8	406.1	438.5
B & H	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0
Diff.	-1202.7	-1173.8	-1103.7	-1067.6	-1032.3	-963.0	-847.7	-757.2	-723.9	-691.5
RUS										
NoT	143.9	126.2	112.6	100.9	90.9	75.6	65.6	57.4	51.8	46.3
Net Ret.	334.0	275.1	280.8	275.0	278.3	320.8	315.0	284.6	296.7	292.7
B & H	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2
Diff.	189.8	130.9	136.5	130.8	134.1	176.6	170.8	140.4	152.5	148.5
SLO										
NoT	96.0	75.0	59.0	46.0	37.0	28.0	22.0	19.0	17.0	13.0
Net Ret.	169.7	179.4	249.2	258.8	282.4	270.8	260.9	251.6	211.5	242.7
B & H	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0
Diff.	-617.3	-607.6	-537.7	-528.2	-504.6	-516.2	-526.0	-535.4	-575.5	-544.2
TUR										
NoT	326.7	276.0	237.6	205.9	179.0	141.1	114.0	94.7	78.9	67.1
Net Ret.	142.9	178.7	196.1	229.4	253.9	278.2	289.0	291.7	299.8	296.7
B & H	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8
Diff.	-92.9	-57.1	-39.7	-6.4	18.1	42.4	53.2	55.9	64.0	60.9

Note: The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the long – only filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling currency. All returns are expressed in percentages.

Other authors such as Hunter (1998) support this finding. To an extent, this study also supports this finding as, overall, the 18 and 20 per cent filters gave positive returns in four of the markets (the Czech Republic, Poland, the Russian Federation and Turkey). This contradicts previous studies that have found that smaller filters are profitable. For example, Fifield et al. (2005) found that filters of 1.0 and 2.5 per cent outperformed the buy-and-hold strategy. In this study, Hungary was not profitable when this strategy was used although Fifield et al. (2005) found that filter rules of 1.0 – 10.0 per cent and 15.0 – 30.0 per cent produced positive returns.

On comparing the long-only strategy in Table 4.3 with the long-and-short strategy, a number of differences emerge. Out of the 240 filters[63], only 27 of the rules were profitable. In addition, the rules that were profitable produced a lower positive return when compared to the short-long strategy. The Russian Federation remained profitable for all the filters, but there is a difference with the other markets. For example, only the 20 per cent filter outperformed the buy-and-hold strategy for the Czech Republic while for Turkey, filters greater than 10 per cent were superior to the buy-and-hold strategy. A conclusion that can be drawn from these results is that the long-only strategy is loss-making. This finding conflicts with Sweeney's finding as he found that short positions performed poorly and were associated with high transaction costs. However, he studied a developed market (the US) whereas less developed markets, prone to volatility and non-trivial price falls, are a more fertile setting for short-based profit generation.

[63] None of the rules outperformed the buy-and-hold strategy when local prices were used.

4.6 Moving Average Results

The results for the 10 moving average rules for the nine emerging markets included in the analysis are presented in Tables 4.4, 4.5 and 4.6 for the short run, long run and bandwidth respectively for the short-long strategy (see Tables 4.4A, 4.5A and 4.6A in Appendix 4.1 for the results in local currency). For the long – only strategy, the results are presented in Tables 4.7, 4.8 and 4.9 (see Tables 4.7A, 4.8A and 4.9A in Appendix 4.1 for the results of the local currency analysis). Each table is split into columns[64]: the first column highlights the country, while the second, third and fourth columns show the number of trades (NoT), the moving average rule profit (Rule), the profit from the buy-and-hold strategy (B & H) and the difference between the rule profit and the buy-and-hold profit (Diff) averaged over the short run (1, 2 and 5 days) and long run (50, 150 and 200 days) periods. Also, a bandwidth of 0 and 1 was introduced[65]. In conjunction with the tables which show the sterling results, reference will also be made to the appendices in order to provide a more detailed examination of the trading rule results.

A visual inspection of Table 4.4 shows that only six of the trading rules outperformed the buy-and-hold strategy; overall these rules appear to have poor predictive ability. Of these six values, four of them relate to the one-day short run moving average while the remaining two are displayed in the five-day short run moving average[66]. This leads to the observation that a two-day short run moving average renders the rule unprofitable as all the values are negative[67]. By contrast, a

[64] For example, Table 4.4 incorporates the short run 1, short run 2 and short run 5.
[65] There are 10 different moving average strategies which are (1, 50, 0), (1, 50, 1), (1, 150, 0), (1, 150, 1), (5, 150, 0), (5, 150, 1), (1, 200, 0), (1, 200, 1), (2, 200, 0) and (1, 200, 1).
[66] A similar conclusion can be reached for the short run average in local prices. On looking at the differences, only 2 of the 27 differences are positive for the Czech Republic and Poland. The remaining values indicated an outperformance of the buy-and-hold strategy.
[67] When using the short selling strategy in local prices, the short run 2 and 5 day differences are all negative, indicating that it is best to use the short run of 1 day to obtain a profitable return and that the markets have poor predictability.

short run moving period of one-day generates a profitable return. In addition, with the exception of the short run moving average period of two-days, it appears that as the short run period increases, the rule profit decreases. The anomalies to this trend are Croatia, Hungary and Turkey[68]. It should be noted that Croatia and Turkey are currently in negotiations to become part of the European Union.

Further examination of the individual results shows that, for the one-day short run moving average rule there were four countries where the rule profits exceeded the buy-and-hold returns; in order of profitability, these are: the Russian Federation (net profit 2359.5 per cent), Poland (131.11), the Czech Republic[69] (72.43) and Turkey (94.7). These countries were also profitable in terms of the filter rule when using the short selling strategy. In relation to the five-day short run moving average strategy, only the Russian Federation and Turkey generated net positive returns (1928.91 and 161.59 per cent, respectively). It should also be noted that only three countries (Croatia, Hungary and Turkey[70]) had a higher rule net profits when the short run period is five days as opposed to one day. Also, as the short run moving average increases, the average number of trades decline (the same trend is apparent for the local price analysis).

A visual inspection of Table 4.5, which shows the long run moving average results, reveals some similarities to the short run moving average rule. Again, out of the 27 rules (9 countries x 3 long-run periods), only 6 generated net average profits. This result implies that the long run moving average rules do not have significant

[68] For the local prices, under the same strategy, over half of the countries shown in the table follow the rule relating to the short run days increasing (ignoring the short run 2 day rule). The anomalies in this case are Croatia, Estonia, Hungary and Romania.
[69] Upon observing the local prices table, only Poland (174.8 per cent) and the Czech Republic (107.1) respectively proved to be profitable.
[70] Turkey was examined by Fifield et al., (2001) who found that as the short run days increased (from 1 to 5 days), there is an increase (ignoring the 2 day moving average) from the 1 to 5 day short run moving average from 128.3 to 140.9 per cent.

predictive ability in the CEE markets[71]. The table also shows that as the long run period increased from 50 to 150 days, average profit increases (rising for 5 of the 9 countries), but when the rule increases to 200 days, average rule profitability falls (falling for 5 of the 9).

On further investigation of the individual profitable results on the long run period, the countries which are profitable are the Russian Federation and Turkey when using the 50, 150 and 200-day long run moving average. In particular, the highest profitable rule is for the Russian Federation of 2874.0 per cent when using the long run of 150 days, with 1419.4 per cent for the long run 50-day moving average and 1260.4 per cent for the long run of 200 days. However, for Turkey, as the long run period increases, the rule profit decreases[72]. For example, the long run moving average of 50 days has the highest profit

[71] When looking at the local prices, the predictive ability is even worse, with only 3 of the rules managing to outperform the buy – and – hold strategy. Similarly, the rules are placed in the long run 50 and 200 day moving average. It should be noted that 2 of profitable rules are located in the 200 day moving average.

[72] Fifield et al., (2001) also used the moving average rules of 50, 100, 150 and 200 days. When the average for the 50, 150 and 200 days are calculated the profits actually increase (100.3, 156.2 and 169.3 per cent respectively), so this result is in direct conflict with the results in this dissertation.

Table 4.4
The Moving Average Results Over The Short – Long Average Period Of 1, 2 And 5 Day(s): Sterling Prices

	Short Run 1				Short Run 2				Short Run 5			
	NoT	**Rule**	**B & H**	**Diff**	**NoT**	**Rule**	**B & H**	**Diff**	**NoT**	**Rule**	**B & H**	**Diff**
CRO	245.0	-151.54	151.8	-303.38	132.5	-76.2	151.8	-228.12	106.50	68.	151.8	-83.14
CZE	162.8	380.8	308.4	72.43	91.	73.	308.4	-235.32	84.2	97.	308.4	-211.19
EST	248.1	93.	489.9	-396.68	134.4	92.	489.9	-397.83	104.80	22.	489.9	-467.25
HUN	238.4	-274.28	331.9	-606.21	135.8	215.8	331.9	-116.05	112.79	196.5	331.9	-135.41
POL	236.9	425.4	294.3	131.11	110.5	44.	294.3	-249.74	98.5	21.	294.3	-273.17
ROM	192.1	1120.68	1129.98	-9.30	99.	42.	1129.98	-1087.07	82.1	51.	1129.98	-1078.52
RUS	160.5	2503.73	144.2	2359.50	85.	103.8	144.2	-40.35	77.1	2073.13	144.2	1928.91
SLO	175.6	233.4	786.9	-553.51	96.	-78.8	786.9	-865.84	81.0	-32.3	786.9	-819.36
TUR	235.3	330.5	235.8	94.70	126.3	224.0	235.8	-11.72	101.90	397.3	235.8	161.59
AVG	215.3	664.1	262.8	401.26	115.0	165.6	259.6	-93.95	96.2	585.6	262.8	322.73

Note: The table details the Number of Trades (NoT), the Net Return (Net Ret.) from the following moving average strategy, the Buy and Hold return (B & H) and the difference (Diff.) in profits from following the short – long moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each moving average rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling. All returns are expressed in percentages.

Table 4.5
The Moving Average Results Over The Short – Long Average Period Of 50, 150 And 200 Day(s): Sterling Prices

Country	Long Run 50				Long Run 150				Long Run 200			
	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff
CRO	370.50	-175.42	151.83	-327.25	151.75	-41.45	151.83	-193.28	150.00	-101.96	151.83	-253.79
CZE	246.26	303.99	308.41	-4.42	106.94	245.06	308.41	-63.36	102.21	259.37	308.41	-49.04
EST	385.20	-217.62	489.98	-707.60	152.00	168.46	489.98	-321.52	147.20	137.73	489.98	-352.24
HUN	340.93	-283.78	331.93	-615.71	157.20	-37.32	331.93	-369.25	154.36	-26.01	331.93	-357.94
POL	366.19	224.25	294.31	-70.07	149.11	237.37	294.31	-56.94	127.67	321.50	294.31	27.19
ROM	311.43	593.81	1129.98	-536.17	116.79	568.90	1129.98	-561.08	106.71	862.40	1129.98	-267.58
RUS	256.68	1419.37	144.22	1275.15	99.61	2874.03	144.22	2729.81	94.35	1260.37	144.22	1116.15
SLO	306.00	133.29	786.98	-653.68	102.50	128.63	786.98	-658.35	96.50	99.30	786.98	-687.68
TUR	345.70	410.61	235.80	174.81	147.67	359.90	235.80	124.10	146.63	241.28	235.80	5.48
AVG	322.37	486.09	262.88	223.21	135.82	723.79	262.88	460.91	131.84	404.86	261.40	143.47

Note: The table details the Number of Trades (NoT), the Net Return (Net Ret.) from the following moving average strategy, the Buy and Hold return (B & H) and the difference (Diff.) in profits from following the short – long moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each moving average rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling. All returns are expressed in percentages.

Table 4.6
The Moving Average Results Over The Short – Long Average Period Of The Bandwidth 0 and 1 Day(s): Sterling Prices

Country	Bandwidth 0				Bandwidth 1			
	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff
CRO	223.90	-107.67	151.83	-259.51	165.70	-77.22	151.83	-229.05
CZE	157.92	251.42	308.41	-56.99	107.91	273.71	308.41	-34.70
EST	221.12	72.26	489.98	-417.71	172.32	85.64	489.98	-404.33
HUN	216.13	-116.22	331.93	-448.15	169.49	-47.96	331.93	-379.89
POL	205.07	261.10	294.31	-33.21	162.83	275.69	294.31	-18.62
ROM	166.69	685.83	1129.98	-444.15	136.69	696.73	1129.98	-433.25
RUS	152.96	1931.16	144.22	1786.93	104.88	1944.12	144.22	1799.89
SLO	168.80	112.63	786.98	-674.35	112.80	123.03	786.98	-663.95
TUR	203.58	318.13	235.80	82.33	170.14	327.05	235.80	91.25
AVG	191.46	431.45	293.34	138.11	149.89	452.24	293.34	158.91

Note: The table details the Number of Trades (NoT), the Net Return (Net Ret.) from the following moving average strategy, the Buy and Hold return (B & H) and the difference (Diff.) in profits from following the short – long moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each moving average rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling. All returns are expressed in percentages.

Table 4.7
The Moving Average Results Over The Long – Only Average Period Of 1, 2 And 5 Day(s): Sterling Prices

Country	Short Run 1				Short Run 2				Short Run 5			
	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff
CRO	122.5	6	151.8	-145.35	67.00	15.	151.8	-135.91	54.	90.	151.8	-61.5
CZE	81.	314.3	308.4	5	46.71	91.	308.4	-217.05	43.	108.0	308.4	-200.33
EST	124.4	-48.4	489.9	-538.46	67.80	99.	489.9	-390.04	53.	80.	489.9	-409.51
HUN	119.6	-98.0	331.9	-430.01	68.89	114.4	331.9	-217.53	57.	89.	331.9	-242.06
POL	119.0	279.0	294.3	-15.2	55.78	49.	294.3	-245.08	49.	42.	294.3	-251.57
ROM	96.	541.2	1129.98	-588.74	50.86	55.	1129.98	-1074.56	41.	25.	1129.98	-1104.89
RUS	80.	475.5	144.2	331.3	43.49	71.	144.2	-72.7	39.	2005.61	144.2	1861.39
SLO	88.	268.8	786.9	-518.13	49.00	21.	786.9	-764.99	41.	38.	786.9	-748.00
TUR	117.9	152.4	235.8	-83.3	64.01	121.1	235.8	-114.66	51.	230.5	235.8	-5.
AVG	107.9	215.6	262.8	-47.2	58.28	100.6	259.6	-158.96	48.	481.0	262.8	218.1

Note: The table details the Number of Trades (NoT), the Net Return (Net Ret.) from the following moving average strategy, the Buy and Hold return (B & H) and the difference (Diff.) in profits from following the long – only moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each moving average rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling. All returns are expressed in percentages.

Table 4.8
The Moving Average Results Over The Long Only Average Period Of 50, 150 And 200 Day(s): Sterling Prices

Country	Long Run 50				Long Run 150				Long Run 200			
	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff
CRO	185.25	-43.52	151.83	-195.35	76.25	51.22	151.83	-100.61	75.50	33.35	151.83	-118.48
CZE	123.26	191.84	308.41	-116.57	53.96	234.04	308.41	-74.38	51.57	241.31	308.41	-67.10
EST	192.80	-149.62	489.98	-639.60	76.60	25.88	489.98	-464.10	74.10	66.41	489.98	-423.56
HUN	170.79	-103.31	331.93	-435.24	79.36	0.48	331.93	-331.45	77.82	6.19	331.93	-325.74
POL	183.63	169.72	294.31	-124.59	75.00	181.25	294.31	-113.07	64.39	198.45	294.31	-95.86
ROM	156.14	364.20	1129.98	-765.78	59.07	171.99	1129.98	-957.99	54.14	498.02	1129.98	-631.96
RUS	128.51	302.02	144.22	157.79	50.24	1461.18	144.22	1316.96	47.51	139.74	144.22	-4.49
SLO	153.00	204.86	786.98	-582.11	52.25	173.09	786.98	-613.88	48.75	158.22	786.98	-628.76
TUR	173.18	216.52	235.80	-19.28	74.38	185.46	235.80	-50.34	73.86	110.78	235.80	-125.02
AVG	161.48	194.15	262.88	-68.74	68.44	384.23	262.88	121.34	66.44	132.57	261.40	-128.83

Note: The table details the Number of Trades (NoT), the Net Return (Net Ret.) from the following moving average strategy, the Buy and Hold return (B & H) and the difference (Diff.) in profits from following the long – only moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each moving average rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling. All returns are expressed in percentages.

Table 4.9
The Moving Average Results Over The Long Only Average Period Of The Bandwidth 0 and 1 Day(s): Sterling Prices

Country	Bandwidth 0				Bandwidth 1			
	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff
CRO	112.30	19.00	151.83	-132.83	83.20	31.25	151.83	-120.58
CZE	79.36	226.03	308.41	-82.39	54.36	230.99	308.41	-77.42
EST	111.04	4.35	489.98	-485.63	86.64	9.63	489.98	-480.34
HUN	108.67	-33.21	331.93	-365.14	85.39	-2.78	331.93	-334.70
POL	103.04	184.60	294.31	-109.72	81.93	187.05	294.31	-107.26
ROM	84.00	336.43	1129.98	-793.55	69.03	345.26	1129.98	-784.72
RUS	76.81	701.88	144.22	557.66	52.79	699.66	144.22	555.44
SLO	85.00	171.79	786.98	-615.19	57.00	175.21	786.98	-611.77
TUR	102.29	160.35	235.80	-75.45	85.58	163.25	235.80	-72.55
AVG	96.21	212.20	293.34	-81.14	75.44	218.87	293.34	-74.47

Note: The table details the Number of Trades (NoT), the Net Return (Net Ret.) from the following moving average strategy, the Buy and Hold return (B & H) and the difference (Diff.) in profits from following the long – only moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each moving average rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling. All returns are expressed in percentages.

Turkey of 410.6 per cent. The rule profit for 150 and 200 days is 359.9 and 241.3 per cent, respectively[73].

Table 4.6 highlights that the introduction of a bandwidth appears to improve the trading strategies' profitability. For example, the profit rule for the moving average increases as the bandwidth size increases. This is the case for all the markets in the table. However, only two markets (the Russian Federation and Turkey) produce a positive profit[74] with both sets of bandwidth. The results presented are similar to the findings documented in previous studies, where a bandwidth is used to increase profits by reducing the weaker buy and sell signals (Hudson et al., 1996; Parisi and Vasquez, 2000; Gunasekarage and Power, 2001). Another reason why the introduction of the bandwidth may help to increase profitability is that is serves to reduce the number of trades, as the bandwidth increases the number of trades, implying that less transactions would be incurred and that costs would be lower.

Examination of Table 4.14A indicates that there is no single rule that can be considered to be the most profitable in each of the nine CEE markets. For two of the markets (the Czech Republic and Poland), the (1, 200, 1) rule is the most profitable, producing 169.7 and 304.2 per cent, respectively. This finding is consistent with the above finding that the introduction of a bandwidth helps to improve profitability. However, the (1, 150, 0) and the (1, 50, 1) rules are the most profitable for the Russian Federation (3703.0 per cent) and Turkey[75] (432.5 per cent). These results emphasise that profitability does not depend on the rule itself, but rather, it depends

[73] When looking at the local prices, it seems that only the Czech Republic and Poland are profitable.
[74] When looking at the local prices, a different result is obtained as only the Czech Republic is profitable when both bandwidths are used.
[75] Turkey was subjected to the moving average rules by Fifield et al., (2001) who found that the (2, 100, 1) rule was the most profitable. However, Fifield et al. (2008) found that the (1, 50, 0) rule was the most profitable when compared to the other rules.

on the country. The other countries were, on the whole, unprofitable when compared to the buy-and-hold strategy[76].

In comparison with the long-only strategy, the long-short results are less impressive. For example, when observing the short run table (Table 4.7), only 3 of the 27 rules yield profits in excess of the buy-and-hold return (two of these rules relate to the one-day period). This observation suggests that, as the profitable rules appear mainly at the shortest day, it is better to use the shortest day in order to produce a profit. However, in relation to cross country differences, two of the three profitable rules relate to the Russian Federation (net profits 333.1 per cent and 1861.39 per cent for the one and five-day short run moving average respectively). The only other net profit shown in Table 4.7 (5.95 per cent) was obtained for the Czech Republic on a one-day basis. Again, the two-day short run moving average rendered the rules unprofitable when compared to the buy – and – hold strategy[77].

For the long run moving average for the long – only strategy (Table 4.8), only 2 out of the 27 rules are profitable, which again suggests that the rules have poor predictive ability. The profitable rules are for the 50 and 150 long run moving average, in both cases for the Russian Federation and with net profits of 157.79 per cent and 1316.96 percent respectively.

[76] For the local currency (Table 4.16A), the Russian Federation proves the highest rule of profit when using the (1, 150, 0) rule generating 1632.6 per cent. Next, Poland produces a profit of 650.6 per cent when using the (1, 200, 0) rule and the (1, 50, 0) rule produces the highest profit for the Czech Republic of 326.2 per cent. The remaining markets were unprofitable.

[77] On an analysis of the local prices, only 2 out of the 27 rules prove to be profitable. Both of them are situated in the 1 day short run moving average column. However, the countries which prove to be profitable when compared to the buy – and – hold strategy are Poland (312.8 per cent) and the Czech Republic (231.6 per cent). The 2 and 5 day short run moving average are unprofitable.

Table 4.10
The Number of Companies that Outperformed the Buy and Hold Strategy with Short – Selling: Sterling Prices

	0.5		1.0		1.5		2.0		2.5		3.0		3.5		4.0		4.5		5.0	
	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
CRO	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4
CZE	6	28	13	21	12	22	17	17	17	17	19	15	18	16	19	15	20	14	18	16
EST	0	5	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1	4
HUN	4	24	5	23	5	23	4	24	4	24	6	22	4	24	6	22	5	23	7	21
POL	7	20	7	20	9	18	9	18	11	16	10	17	9	18	10	17	8	19	7	20
ROM	3	4	2	5	2	5	2	5	2	5	2	5	2	5	2	5	3	4	3	4
RUS	52	7	50	9	52	7	52	7	52	7	54	5	52	7	52	7	52	7	50	9
SLO	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
TUR	19	168	32	155	43	144	56	131	61	126	66	121	73	114	83	104	93	94	101	86

Note: The table details the short – long filter strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each company which outperformed the buy and hold strategy. The "Y" represents the number of companies that outperformed the buy – and – hold strategy and the "N" accounts for the number of companies that did not outperform the buy – and – hold strategy. The trading rules were implemented using share prices denominated in sterling currency.

Table 4.10 (continued)
The Number of Companies that Outperformed the Buy and Hold Strategy with Short – Selling: Sterling Prices

	6.0		7.0		8.0		9.0		10.0		12.0		14.0		16.0		18.0		20.0	
	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
CRO	0	4	0	4	0	4	0	4	1	3	2	2	1	3	1	3	0	4	0	4
CZE	19	15	21	13	20	14	18	16	19	15	21	13	18	16	18	16	18	16	19	15
EST	1	4	1	4	1	4	1	4	1	4	2	3	2	3	2	3	2	3	2	3
HUN	8	20	8	20	7	21	8	20	8	20	6	22	5	23	5	23	7	21	10	18
POL	7	20	8	19	11	16	12	15	12	15	13	14	15	12	13	14	14	13	14	13
ROM	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	4	3	4	3
RUS	51	8	48	11	48	11	44	15	48	11	49	10	47	12	47	12	43	16	46	13
SLO	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
TUR	108	79	120	67	122	65	128	59	134	53	133	54	143	44	141	46	144	43	141	46

Note: The table details the short – long filter strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each company which outperformed the buy and hold strategy. The "Y" represents the number of companies that outperformed the buy – and – hold strategy and the "N" accounts for the number of companies that did not outperform the buy – and – hold strategy. The trading rules were implemented using share prices denominated in sterling currency.

Table 4.11
The Number of Companies that Outperformed the Buy and Hold Strategy for the Long – Only Filter Trading Strategy: Sterling Prices.

	0.5		1.0		1.5		2.0		2.5		3.0		3.5		4.0		4.5		5.0	
	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
CRO	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4
CZE	6	28	13	21	12	22	13	21	13	21	14	20	15	19	15	19	15	19	16	18
EST	0	5	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1	4
HUN	4	24	4	24	4	24	3	25	3	25	4	24	5	23	7	21	5	23	6	22
POL	7	20	7	20	8	19	9	18	9	18	8	19	9	18	11	16	8	19	7	20
ROM	2	5	2	5	0	7	0	7	0	7	0	7	0	7	2	5	2	5	1	6
RUS	47	12	46	13	47	12	47	12	46	13	45	14	46	13	46	13	46	13	45	14
SLO	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
TUR	15	172	25	162	32	155	45	142	56	131	57	130	61	126	75	112	79	108	87	100

Note: The table details the long – only filter strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each company which outperformed the buy and hold strategy. The "Y" represents the number of companies that outperformed the buy – and – hold strategy and the "N" accounts for the number of companies that did not outperform the buy – and – hold strategy. The trading rules were implemented using share prices denominated in sterling currency.

Table 4.11 (continued)
The Number of Companies that Outperformed the Buy and Hold Strategy for the Long – Only Trading Strategy: Sterling Prices.

	6.0		7.0		8.0		9.0		10.0		12.0		14.0		16.0		18.0		20.0	
	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
CRO	0	4	0	4	0	4	0	4	1	3	1	3	1	3	1	3	0	4	0	4
CZE	16	18	16	18	17	17	17	17	16	18	17	17	17	17	14	20	15	19	15	19
EST	1	4	1	4	1	4	1	4	1	4	0	5	1	4	1	4	1	4	1	4
HUN	7	21	7	21	7	21	8	20	8	20	5	23	6	22	6	22	8	20	8	20
POL	8	19	8	19	11	16	11	16	11	16	13	14	12	15	12	15	14	13	13	14
ROM	2	5	1	6	2	5	2	5	3	4	3	4	3	4	4	3	4	3	4	3
RUS	46	13	45	14	42	17	41	18	41	18	42	17	39	20	37	22	33	26	35	24
SLO	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
TUR	99	88	108	79	107	80	117	70	125	62	125	62	129	58	133	54	132	55	136	51

Note: The table details the long – only filter strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each company which outperformed the buy and hold strategy. The "Y" represents the number of companies that outperformed the buy – and – hold strategy and the "N" accounts for the number of companies that did not outperform the buy – and – hold strategy. The trading rules were implemented using share prices denominated in sterling currency.

Table 4.12
The Number of Companies that Outperformed the Buy and Hold Strategy with Short – Selling: Sterling Prices

	(1, 50, 0)		(1, 50, 1)		(1, 150, 0)		(1, 150, 1)		(5, 150, 0)		(5, 150, 1)		(1, 200, 0)		(1, 200, 1)		(2, 200, 0)		(2, 200, 1)	
	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
CRO	0	4	0	4	0	4	1	3	1	3	2	2	1	3	1	3	0	4	0	4
CZE	16	18	18	16	13	21	14	20	9	25	11	23	13	21	13	21	12	22	12	22
EST	1	4	1	4	2	3	2	3	1	4	1	4	2	3	2	3	2	3	2	3
HUN	5	23	5	23	5	23	5	23	6	22	6	22	5	23	5	23	11	17	12	16
POL	14	13	15	12	15	12	13	14	7	20	7	20	15	12	15	12	7	20	8	19
ROM	3	4	3	4	4	3	4	3	2	5	2	5	5	2	5	2	3	4	3	4
RUS	53	6	52	7	56	3	57	2	30	29	32	27	56	3	56	3	25	34	29	30
SLO	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
TUR	132	55	135	52	118	69	120	67	137	50	139	48	104	83	108	79	101	86	102	85

Note: The table details the short – long filter strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each company which outperformed the buy and hold strategy. The "Y" represents the number of companies that outperformed the buy – and – hold strategy and the "N" accounts for the number of companies that did not outperform the buy – and – hold strategy. The trading rules were implemented using share prices denominated in sterling currency.

Table 4.13
The Number of Companies that Outperformed the Buy and Hold Strategy for the Long – Only Moving Average Trading Strategy: Sterling Prices

	(1, 50, 0)		(1, 50, 1)		(1, 150, 0)		(1, 150, 1)		(5, 150, 0)		(5, 150, 1)		(1, 200, 0)		(1, 200, 1)		(2, 200, 0)		(2, 200, 1)	
	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
CRO	0	4	0	4	1	3	2	2	1	3	1	3	1	3	1	3	0	4	0	4
CZE	11	23	10	24	10	24	8	26	9	25	8	26	9	25	9	25	8	26	8	26
EST	1	4	1	4	1	4	1	4	1	4	1	4	0	5	0	5	1	4	1	4
HUN	4	24	4	24	4	24	4	24	5	23	5	23	3	25	3	25	7	21	7	21
POL	13	14	14	13	12	15	12	15	5	22	5	22	13	14	14	13	8	19	8	19
ROM	3	4	3	4	3	4	3	4	2	5	2	5	4	3	3	4	3	4	3	4
RUS	40	19	42	17	42	17	43	16	30	29	32	27	41	18	39	20	29	30	27	32
SLO	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2
TUR	114	73	118	69	86	101	86	101	120	67	118	69	75	112	78	109	84	103	86	101

Note: The table details the long – only filter strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each company which outperformed the buy and hold strategy. The "Y" represents the number of companies that outperformed the buy – and – hold strategy and the "N" accounts for the number of companies that did not outperform the buy – and – hold strategy. The trading rules were implemented using share prices denominated in sterling currency.

per cent, respectively[78]. For the long-only strategy, none of the rules outperform the buy-and-hold strategy in sterling or local currency whether a bandwidth is included or not. However, Table 4.9 demonstrates that, as with the short-long results, the trading rule performs better with a higher than lower bandwidth for most markets.

It should also be noted that if transaction costs were removed, the results would not be any different in substance from the current results. Furthermore, even if transaction costs were set at 0.4 per cent for all markets, the results would not be materially different. Another interesting point to note is that the countries that produced the most profitable filter rules overall (the Russian Federation and Turkey), are not part of the EU.

4.6.1 Comparison of Rule Performance based on number of Firms.

It is important to note that the study may be subject to bias in that the analysis so far has been based on examining the size of profits. However, the number of firms from each country varies greatly in the study (and do not reflect the size of each market) and so the impression gained by simply investigating mean profits may be erroneous. Tables 4.10-4.13 therefore reports the number of companies in each country that outperformed the buy-and-hold strategy. Inspection of these tables indicates that it is Turkey, Russia and Slovenia where the greatest degree of predictability, appearing to confirm the impression gained from analysis of the size of average trading profits.

[78] In relation, to the local prices, none of the 27 rules outperformed the buy – and – hold strategy.

4.7 Conclusion

This chapter presents the results from a comprehensive analysis of the performance of filter and moving average rules. Overall, the results show that the CEE markets studied have poor predictive ability with the exception of the Russian Federation. In terms of the filter rule, the profitability persists for the larger filters (18 and 20 per cent) while, for the moving average rules, longer moving averages perform best. Overall, this chapter suggests that no one single rule is profitable throughout all the CEE countries; trading rule profitability is dependant on the market. Nevertheless, the analysis found evidence of some 'pockets' of inefficiency which can be exploited by implementing a trading rule based on filter or moving averages. It should be noted that the sample sizes may have an influence on the findings of predictability. For example, evidence of predictability in the larger and relatively developed markets of the Czech Republic, Russia and Turkey is consistent with the greater degree of interest amongst the financial media likely to exist in these nations. Similarly, for a market such as Slovenia, where only two countries are represented, relatively low levels of predictability might reasonably be expected.

Chapter Five

A Further Examination of Trading Rule Profitability

5.1 Introduction

The results documented in Chapter 4 indicated that some technical trading strategies based on filters and moving averages can generate profits greater than those available from a simple buy-and-hold strategy when applied to CEE emerging stock markets. However, the results also showed that these rules should not be employed indiscriminately in markets in this region as their profitability varied from one market to the next; for example, the rules performed poorly other than in the Russian Federation, the Czech Republic and Turkey.. In addition, the analysis contained in the previous chapter did not assess the statistical significance of the results. The purpose of this chapter is to test the statistical significance of the rules that were found to be profitable in the previous analysis. In particular, a method of bootstrapping is used to test whether or not the profits are statistically significant.

The remainder of the chapter is structured as follows. In section 5.2, a brief literature review is given to establish a background for the analysis. Section 5.3 explains the bootstrapping method used in this dissertation while section 5.4 presents the results from conducting the bootstrapping analysis. Finally section 5.5 offers some concluding remarks regarding the notion of EMH and the bootstrapping procedure itself.

5.2 A Brief Literature Review

A number of studies have employed bootstrapping techniques to test the statistical significance of trading rule profits. One of the most prominent studies to date which has used a model based on bootstrapping is Brock et al. (1992). Brock et al. (1992) argued that there are several benefits from using the bootstrap method. First, they argued that the procedure facilitates an assessment of the statistical

significance of the trading rules examined. Second, the authors contend that the bootstrapping procedure is more powerful than the simple t-test and, finally, they argue that the method can be used to examine the standard deviation of returns during buy and sell periods and, therefore, it allows account to be taken of the riskiness of the trading rules. To assess the statistical significance of trading rule profitability, Brock et al. (1992) used the conditional return on a buy (or sell) signal from the original data and compared it to a simulated data series. The models used in the study were the random walk with drift, the autoregressive process, the GARCH and the Exponential GARCH model. Five hundred samples were simulated for each model and for each trading rule examined.

Several other studies have used Brock et al. (1992) as a benchmark and have used similar techniques to assess trading rule profitability using different data sets (Bessembinder and Chan, 1995; Ratner and Leal, 1999; Atmeh and Dobbs, 2006). For example, Bessembinder and Chan (1995) calculated a bootstrapped p-value on the difference between the buy and sell day returns. In particular, they scrambled the actual returns data, sampled from this dataset to generate simulated returns and then derived simulated prices. The trading rules were then applied to the simulated data series and the returns calculated. This process was repeated 500 times to generate an empirical distribution of returns.

Similarly, Ratner and Leal (1999) used a procedure which involved scrambling the actual inflation-adjusted returns data by sampling with replacement from the original data series to form a simulated series. Five hundred price series were simulated and the trading strategies were then applied to the simulated data series and the mean buy and sell returns calculated. Finally, Atmeh and Dobbs (2006) also used a method of bootstrapping in their study of the performance of trading rules

using data for the Jordanian Stock market. In particular, the random walk model, the autoregressive model and the GARCH – M model were utilised in this study. The bootstrapped series were generated by scrambling the actual returns and calculating the log price difference. The scrambling procedure generates a new series of returns by randomly sampling from the actual time series with replacement; the scrambled series has the same conditions as the actual series and it is independent and identically distributed. Simulated prices are then derived from the simulated returns and the trading rules applied to the data.

5.3 The Bootstrap Method

To further examine the predictive ability and potential profitability of trading rules in the CEE emerging stock markets, the bootstrap method was used to test the statistical significance of the trading rule profits in the Czech Republic, the Russian Federation and Turkey, i.e. those where Chapter 4 reported the trading rules as being able to outperform a naïve trading strategy. In addition, only the companies in these countries that outperformed the buy-and-hold strategy were used.

The daily closing prices for each of these companies were taken and the returns were calculated. Ninety-nine return series were then simulated from the actual returns; these returns were then used to derive ninety-nine simulated price series. Filter and moving average rules were then applied to the simulated and actual price series and the returns were noted. In particular, the results from applying the trading rules were examined to see if the return on the actual price series was in the top ten returns. If this is the case, this would indicate that the trading rule profit was significant at the ten per cent level. More specifically, a finding of profitable trading rules suggest that there are trends in share prices that can be exploited. The process of

simulating price series from the actual price data is important as it would remove any trends that are present in the data. The finding that the trading rule profit using the actual data is situated in the top ten out of the one hundred profit figures would suggest that there are trends in the original share price data; this finding would provide evidence against the weak form of the EMH.

5.4 Results from the Bootstrap Analysis

The results from performing the bootstrap procedure for the Czech Republic, the Russian Federation and Turkey are summarised in Tables 5.1 – 5.3 for the filter rules and Tables 5.4 – 5.6 for the moving average rules; the analysis was conducted using sterling prices. The first column of each table shows the rules that were tested in the study while the remaining columns detail the position of the profit generated using actual share prices in relation to those generated from the simulated price series. If the rule profits are positioned between 1 and 10, this means that they are statistically significant.

A visual inspection of Table 5.1 shows that the profits generated by the filter rules using data for the Czech Republic are statistically significant in the majority of cases. Specifically, for the short-long strategy, 96 per cent of the 169 filter rules that were profitable when compared to the buy-and-hold strategy are statistically significantly profitable. This result suggests that the Czech Republic is weak form inefficient. Further observation of the table shows that all the filters of less than 12 per cent are statistically significantly profitable while in a small number of cases, larger filters, ranging in size from 14 to 20 per cent, are not statistically significant. Similar results were obtained for the long-only strategy where the profits from following the small-sized filter rules are consistently statistically significant.

Table 5.1

Results for the position of the actual return after bootstrapping for the Czech Republic using both strategies with the filter rule

The Czech Republic

Short-Long Strategy										
Filter	**1 - 10**	**11 - 20**	**21 – 30**	**31 - 40**	**41 - 50**	**51 - 60**	**61 - 70**	**71 - 80**	**81 - 90**	**91 - 100**
0.5	6									
1	13									
2.5	17									
5	17									
7	21									
10	19									
12	21									
14	16	2								
16	16	1		1						
20	16	2		1						
Long – Only Strategy										
0.5	6									
1	13									
2.5	13									
5	16									
7	17									
10	16									
12	17									
14	14	1	2							
16	12				1	1				
20	13	1		1						

Note: The table details the position of the actual return after the bootstrapping technique. This particular table represents the filter rules where the net returns outperformed the buy – and – hold strategy.

Table 5.2

Results for the position of the actual return after bootstrapping for the Russian Federation using both strategies with the filter rule

The Russian Federation

Short-Long Strategy										
Filter	**1 - 10**	**11 - 20**	**21 - 30**	**31 – 40**	**41 - 50**	**51 - 60**	**61 - 70**	**71 - 80**	**81 - 90**	**91 - 100**
0.5	52									
1	50									
2.5	52									
5	50									
7	48									
10	48									
12	49									
14	47									
16	47									
20	45	1								
Long – Only Strategy										
0.5	47									
1	44		2							
2.5	43	2	1							
5	42	1	2							
7	40	1	2	1				1		
10	38		1	1			1			
12	39		1	1		1				
14	36		1	1		1				
16	34		2		1					
20	33			1		1				

Note: The table details the position of the actual return after the bootstrapping technique. This particular table represents the filter rules where the net returns outperformed the buy – and – hold strategy.

Table 5.3
Results for the position of the actual return after bootstrapping for Turkey using both strategies with the filter rule

Turkey

Short-Long Strategy										
Filter	**1 - 10**	**11 - 20**	**21 - 30**	**31 – 40**	**41 - 50**	**51 - 60**	**61 - 70**	**71 - 80**	**81 - 90**	**91 - 100**
0.5	18			1						
1	31			1						
2.5	60				1					
5	100			1						
7	119				1					
10	133			1						
12	133									
14	143									
16	141									
20	141									
Long – Only Strategy										
0.5	15									
1	24			1						
2.5	55				1					
5	86			1						
7	108									
10	125									
12	125									
14	129									
16	133									
20	136									

Note: The table details the position of the actual return after the bootstrapping technique. This particular table represents the filter rules where the net returns outperformed the buy – and – hold strategy.

Table 5.4
Results for the position of the actual return for the Czech Republic: moving average strategies

The Czech Republic

Short-Long Strategy										
MA	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**51 - 60**	**61 - 70**	**71 - 80**	**81 - 90**	**91 - 100**
(1,50,0)	16									
(1,50,1)	18									
(1,150,0)	13									
(1,150,1)	14									
(5,150,0)		2		1	3	1	2			
(5,150,1)		2	1	3	2	3				
(1,200,0)	13									
(1,200,1)	13									
(2,200,0)	2	1	3	3	2	1				
(2,200,1)	1	1	3	3	2	2				
Long – Only Strategy										
(1,50,0)	14									
(1,50,1)	14									
(1,150,0)	14									
(1,150,1)	14									
(5,150,0)		2		1	1	1	2	1		
(5,150,1)		2	1	2	2	1	1	1		
(1,200,0)	13									
(1,200,1)	14									
(2,200,0)	2	2	2	1	1	2	1			
(2,200,1)	1	1	2		2	4	1			

Note: The table details the position of the actual return after the bootstrapping technique. This particular table represents the moving average rules where the net returns outperformed the buy – and – hold strategy.

Table 5.5
Results for the position of the actual return for the Russian Federation: moving average strategies

The Russian Federation

Short-Long Strategy										
MA	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**51 - 60**	**61 - 70**	**71 - 80**	**81 - 90**	**91 - 100**
(1,50,0)	53									
(1,50,1)	52									
(1,150,0)	54		1	1						
(1,150,1)	54		1	1	1					
(5,150,0)				2	5	9	5	6	2	1
(5,150,1)		1	2	4	9	4	7	4	1	
(1,200,0)	52	1		1			1		1	
(1,200,1)	52		1	1				1	1	
(2,200,0)	1			3	5	6	5	4	1	
(2,200,1)	2	1	2	3	5	3	9	1	1	
Long – Only Strategy										
(1,50,0)	40									
(1,50,1)	42									
(1,150,0)	41			1						
(1,150,1)	42			1						
(5,150,0)			3	2	4	9	4	5	3	
(5,150,1)			1	4	8	10	5	2	2	
(1,200,0)	41									
(1,200,1)	39									
(2,200,0)				1	12	4	8	2	2	
(2,200,1)			2	2	6	7	9		1	

Note: The table details the position of the actual return after the bootstrapping technique. This particular table represents the moving average rules where the net returns outperformed the buy – and – hold strategy.

Table 5.6
Results for the position of the actual return after bootstrapping for Turkey using both strategies with the moving average rule

Turkey

Short-Long Strategy										
MA	**1 - 10**	**11 - 20**	**21 - 30**	**31 - 40**	**41 - 50**	**51 - 60**	**61 - 70**	**71 - 80**	**81 - 90**	**91 - 100**
(1,50,0)	132									
(1,50,1)	135									
(1,150,0)	118									
(1,150,1)	120									
(5,150,0)			5	12	32	38	26	15	8	1
(5,150,1)			6	18	33	33	29	14	6	
(1,200,0)	104									
(1,200,1)	108									
(2,200,0)	2	4	7	13	26	26	14	8	1	
(2,200,1)	2	3	10	20	21	26	13	5	2	
Long – Only Strategy										
(1,50,0)	114									
(1,50,1)	118									
(1,150,0)	86									
(1,150,1)	86									
(5,150,0)			7	8	26	27	28	16	5	3
(5,150,1)			6	19	20	34	22	9	7	1
(1,200,0)	75									
(1,200,1)	78									
(2,200,0)		4	7	15	16	21	14	5	1	
(2,200,1)		2	11	10	21	18	13	5	2	

Note: The table details the position of the actual return after the bootstrapping technique. This particular table represents the moving average rules where the net returns outperformed the buy – and – hold strategy.

Table 5.2 shows that the short-selling filter strategy is consistently statistically significant in the Russian Federation; out of the 488 rules tested, only one of the rules generated a profit that was not located within the top ten. This result provides strong evidence against the weak form of the EMH. However, the results for the long-only strategy show a completely different picture. On first instance, only the smallest filter of 0.5 per cent had all significant rules and 4 filter rules between 2.5 and 7 per cent are close to being significant and the remaining 23 rules are not significant. Again the numbers of significant trading rules falls when adopting the long-only strategy.

For Turkey, on observing Table 5.3, the profitability proved to be successful in the majority of cases as 1025 rules, 99 per cent are successful. However, Turkey is the only country that differs when it comes to looking at the rules that are not significant. In Turkey, the smaller rules which range from 0.5 to 10 per cent had some rules that were not significant and the larger rules are all significant. Nevertheless, only 6 of the rules showed signs of non significance. For the long-only strategy the filters ranging from 1 to 5 per cent, are not all significant and the number of significant rules dropped when compared to the short selling strategy.

In relation to the moving average rules for the Czech Republic referring to Table 5.4, out of 131 rules, only 68 per cent were significant. This supports the filter rule bootstrapped results as the weak form of EMH is contradicted. All the rules, on observation, looked to be significant with the exception of 4 rules. The (5, 150, 0) and (5, 150, 1) proved to be non significant in all cases, and the rules (2, 200, 0) and (2, 200, 1) only had a small number of significant profits. With the long-only strategy, it mirrors a similar story in relation to the rules being significant and non significant. In the majority of the cases, the long-only produced a lesser number of significant rules when compared to the short selling strategy.

On reviewing the Russian Federation in Table 5.5, just like the filter rules, there is strong support for the rejection of weak form of EMH. However, the evidence here is not as strong as the filter rules. For example, out of 389 rules, only 68 per cent of the rules could be deemed significant. The exceptions in the Russian Federation are very similar to the Czech Republic with the addition of the (1, 150, 0) and (1, 150, 1) rule, which shows signs of being non significant. When the long – only approach is taken, only the (5, 150, 0), (5, 150, 1), (2, 200, 0) and (2, 200, 1) rules show no significance.

Finally, for Turkey's moving average rule, on a visual inspection of the Table 5.6, it seems that the majority of the profits are significant for the short selling strategy. In particular, out of 1196 rules, only 60 per cent of the rules are significant. Again, signs of non significance is present in the (5, 150, 0) and (5, 150, 1) rules and the other rules such as the (2, 200, 0) and (2, 200, 1) rules have mainly non significant profits. On adopting a long – only strategy, there are a far less number of rules that are significant and similarly to the long – only approach of the Russian Federation, all the rules looked to be significant apart from the (5, 150, 0), (5, 150, 1), (1, 200, 0) and (1, 200, 1) rules.

5.5 Conclusion

There appears to be a number of mixed findings in this chapter. For example, on observing the filter rules, for the Czech Republic it should be noted that the larger filters ranging from 14 to 20 per cent using both the short-long and long – only strategy shows signs of non significant trading rules. However, when observing the Russian Federation filter results, only the 20 per cent rule shows a small sign of not conforming with the pattern of significance for the short-long strategy. However, for

the long-only strategy all the filter rules except the 0.5 per cent rule shows signs of non significance. Turkey's filter rules are an exception to the pattern of the larger rules tendency to exhibit non significance, only the smaller filters comply with the pattern. One reason that could be suggested for a different set of rules showing a lack of significance could be due to the fact that Turkey is not a post communist country. It should also be noted that the larger filters tended to produce the higher profits, in the Czech Republic and the Russian Federation, the larger filters showed small signs of non significance in the short selling and long-only strategy.

Overall from reviewing all the moving average tables, it is clear the majority of the rules are significant but some of the rules prove to be not significant ((5, 150, 0), (5, 150, 1), (1, 200, 0) and (1, 200, 1)). It should also be noted, from Chapter 4, on reviewing the three countries in question, it is more profitable to adopt a short selling approach than the long-only approach. Yet, after the bootstrapping, there are a lesser number of profitable rules that are significant when using the long-only approach. In addition, the three markets in this particular chapter reject the notion of weak form EMH.

Chapter Six

Conclusion

6.1 Introduction

The current dissertation has examined the predictability and potential profitability of two of the simplest types of trading rules: the filter rule and the moving average rule. In particular, the performance of these trading rules was examined using data for a selection of nine emerging stock markets in Central and Eastern Europe, namely Croatia, the Czech Republic, Estonia, Hungary, Poland, Romania, the Russian Federation, Slovenia and Turkey, over the 11-year period, January 1997 – December 2007. The analysis was undertaken in sterling in order to adopt the perspective of a UK investor, although some of the analysis was also conducted using the local currency. In addition, transaction costs for each market were estimated and incorporated into the analysis in order to evaluate the performance of technical trading rules in a costly trading environment. The thesis commenced by summarising the early and later evidence of the standard tests used to test whether successive prices changes are independent and whether there are trends in share price data. In particular, the literature which has employed serial correlation and runs tests, and the more sophisticated variance ratio test was reviewed. Next, a review of the literature which has tested the profitability of trading rules in both developed and emerging markets was presented. The main characteristics of the Central and Eastern European emerging stock markets was also provided to give a background to the analysis; a short discussion of the key economic characteristics of these countries was also given. A comprehensive analysis of the performance of filter and moving average trading strategies was then undertaken for the nine markets included in the study. Thereafter, the bootstrap method was used to investigate whether the profitable rules were statistically significant.

The remainder of this chapter is organised as follows. Section 6.2 outlines the main conclusions of the dissertation. The limitations of the study are discussed in Section 6.3. Finally, Section 6.4 outlines areas for further research.

6.2 Conclusions

A number of key findings emerged from the empirical work that was conducted in this dissertation. First, the analysis in Chapter 4 showed that some of the stock markets in the CEE region did exhibit some degree of predictability in their returns although the ability of technical trading rules to predict future changes in some markets was limited. This finding contradicts the evidence that has been documented for developed markets which suggests that trading rules cannot be used to generate superior returns after the deduction of transaction costs (Brock et al., 1992; Hudson et al., 1996; Ratner and Leal, 1999; Fifield et al., 2005).

Other studies which have focused on emerging stock markets (Bessembinder and Chan, 1995; Huang, 1995; Hunter, 1998; Ratner and Leal, 1999; Coutts and Cheug, 2000; Parisi and Vasquez, 2000; Gunasekarage and Power, 2001; Shachmurove et al., 2001; Fifield et al., 2005, 2008; Atmeh and Dobbs, 2006; Al-Abdulqader et al., 2007) have produced a number of mixed results; a range of filter and moving average rules have been examined in these studies. However, there appears to be no underlying pattern in terms of geographical location; early studies have tended to support the notion of weak form efficiency while later studies have documented evidence against the weak form of the EMH.

Over the years, it has been well documented that investors should use emerging stock markets in their current portfolio. A number of studies have highlighted the potential advantage from diversifying their portfolio with the use of

emerging stock markets (Divecha et al., 1992; Lorinc, 1995; Köke, 1999; Gilmore et al., 2005; Middleton et al., 2007a,b). In addition, there is a surplus amount of evidence that states technical trading rules are profitable in emerging markets (Bessembinder and Chan, 1995; Ratner and Leal, 1998; Coutts and Cheung, 2000; Parisi and Vasquez, 2000; Gunasekarage and Power, 2001; Fifield et al., 2005). These studies offer evidence in support of the use of technical trading rules in the Asian region. For example, countries such as Indonesia, Indian, Korea, Malaysia, Pakistan, the Philippines, Singapore, Sri Lanka, Taiwan and Thailand showed that the filter rule and the moving average rule earned profits that exceeded that of the simple buy – and – hold strategy. In contrast, the results for countries in Europe and Latin America, no trading rule seemed to produce a profit on a consistent basis.

Also, it should be noted that the notion of the filters that produced the largest amount of market activity proved to the most profitable is rejected in this study. For example, on looking at the smallest filters in the study (0.5 – 3.5 per cent), out of the nine markets, eight of the markets proved not to be profitable when using both strategies and it was only the Russian Federation that showed signs of profitability when using the smaller filters. In fact, after taking account of transaction costs when adopting the short selling strategy with the 1 per cent filter, the return for the short selling and long – only strategies were 4798.6 and 4338.9 per cent which implied that transaction costs had a small effect on the overall profit. The bootstrapping method confirmed the importance for the size of filter, the smaller filters tended to be statistically significant. However, Huang (1995) reasoning stated that strategies that incurred the greatest transaction costs would eliminate any profit, and this reasoning was represented in all the markets in this dissertation bar the Russian Federation.

Another point which emerged from this study is that profitability persists for the larger filter sizes in a number of cases. In particular, the 18 and 20 per cent filters were successful in several of the markets in the CEE region. This implies that trends in the share returns are larger and more persistent in the CEE markets. The previous literate had found that the filters between 4 to 18 per cent are successful after transaction costs (Huang, 1995; Hunter, 1998). However, the profitable larger filters only occur in the Czech Republic, the Russian Federation and Turkey.

The next finding of this dissertation relates to the performance of the moving average rules. When the results are averaged over the short run period, long run period and the bandwidth, the countries offered only a few opportunities to gain profitability. Ignoring short run 2 as this rule was always unprofitable, when then short run moving increased from 1 to 5, there is no discernable pattern, with the profits fluctuating randomly. The long run moving average rules produced a similar results, with no clear patterns between the rules itself. The bandwidth for the short selling strategy provided an interesting finding, when the difference between the net return and buy – and – hold strategy is negative and the bandwidth increases, the profitability decreases. However, when the difference is positive and the bandwidth increases, the profitability also increases. Therefore, the selection of a single country to try and exploit any sort of profitability from the share price behaviour is unlikely to result in a successful investment strategy as the profitability between all the countries varies.

Another finding dealt with the strategies utilised in this study the (i) short selling strategy; and (ii) the long-only strategy. Traditionally, many institutions would favour the long-only strategy when it comes to exploiting the market to make the profit. However, on comparing both strategies, it seems that if an individual was

going to invest in the CEE region, a short selling strategy should be adopted in order to earn excess profits.

Also, the analysis conducted in this study was conducted in both sterling and the local currency. There were some notable differences. For example, using the short selling filter strategy for the Czech Republic, profitability started from the 1.5 per cent filter in local currency. In addition, for Poland profitability started from the 16 per cent filter, while filter rules were consistently unprofitable in the Russian Federation when prices were expressed in terms of the local currency. When adopting a long-only strategy, the Russian Federation was unprofitable and the Czech Republic produced excess returns under the filter the 5, which was not the case under the sterling currency, but a similarity there was a profit under the 20 per cent filter in the Czech Republic and Poland using local currency.

For the moving average rule, profitability decreased when compared to local currency. Only the Czech Republic and Poland managed to produce profitable amounts under the short selling strategy on a minimal number of occasions, when the moving averaged rules were at their shortest (Short Run 1, Long Run 50).

6.3 Limitations

This dissertation has attempted to contribute to knowledge by providing evidence on the weak form of the EMH for a selection of CEE emerging stock markets. In particular, it examined the predictability of two of the most popular trading rules: filter and moving average rules. In addition, transaction costs were incorporated into the analysis so that an assessment could be made of the performance of trading rules in a costly trading environment. Although the empirical work

presented in this dissertation represents a comprehensive analysis of trading rule performance in CEE emerging markets, the study does suffer from a few limitations.

One of the main limitations is that the study was hampered by the lack of data covering markets in the CEE region. For example, only nine markets in the CEE region are considered in this study; it was not possible to include other CEE markets, such as Bulgaria, Latvia, Lithuania and the Ukraine, due to the unavailability of daily closing price data. Data limitations also prevented an examination of the profitability of technical trading rules over a longer period of time; the sample period studied covers only the 11-year period January 1997 – December 2007. Nevertheless, the time period used is long enough to obtain preliminary results and form a constructive conclusion. Overall, the relatively short sample period should not affect the creditability of the dissertation, although it is recognised that a longer time period may lead to different conclusions.

Second, due to the time constraints associated with completing a Masters dissertation, the researcher was unable to split the sample period into a number of different sub-periods; such an analysis would have been of interest as a number of events occurred in the markets over the time period studied. In addition, the performance of trading rules could have been examined over shorter time periods to determine if it varied markedly from one period to the next. Third, the data used included company level share price data for each of the nine CEE markets studied. However, some companies had to be omitted from the analysis as their share prices did not change for very long periods of time. Therefore, the number of companies analysed for each country is not equal. In addition, the number of shares selected for study does not reflect the size of the stock market.

Fourth, the transaction cost data that were used were estimated and were taken from different sources; the research would possibly benefit from more accurate data. Nevertheless, the study provides an indication of the profitability of filter and moving average strategies in a costly trading environment; most previous studies do not take the costs of trading into account.

6.4 Future Research

One area that could be researched more thoroughly is the use of technical trading rules in CEE stock markets over a longer time period; some previous studies have suggested that these rules may only be profitable over very long periods (Brock et al., 1992; Coutts and Cheung, 2000). In addition, future research could examine more variations of the filter and moving average rules, as well as other different types of trading strategy including, for example, the trading range breakout rule.

A more accurate analysis of the impact of transaction costs on the profitability of these rules could also be undertaken. Unfortunately, the researcher was only able to get an estimate of transaction cost data from articles and an investment practitioner. Alternatively, given the difficulty in obtaining precise estimates of the trading costs involved in implementing these strategies, future research could undertake a break-even analysis in order to determine how low transaction costs would have to be in order for the rules to be profitable relative to a corresponding buy-and-hold strategy.

Future research could also conduct a more comprehensive analysis of the extent of market efficiency for the CEE region. More specifically, future research could perform a battery of tests such as serial correlation and runs tests as well as the more sophisticated variance ratio and non-parametric variance ratio tests.

Appendix 4.1

Table 4.1A
Descriptive Statistics for Daily Returns from 9 Central and Eastern European Stock Markets over 1997 – 2007: Local Currency

	MEAN	STDEV	MIN	MAX	SKEW	KURT	AD	KS
CRO	0.000341	0.01711	-0.154367	0.15718	0.455*	13.127*	97.626*	0.116*
CZE	0.000203	0.00583	-0.071068	0.07572	0.296*	22.472*	51.602*	0.080*
EST	0.000419	0.02069	-0.186972	0.17370	-0.470*	11.642*	79.851*	0.109*
HUN	0.000387	0.01275	-0.115855	0.08272	-1.034*	12.589*	67.109*	0.098*
POL	0.000224	0.01302	-0.117925	0.08121	-0.730*	6.706*	23.869*	0.060*
ROM	0.000960	0.02387	-0.356385	0.34981	-0.121*	40.844*	77.044*	0.102*
RUS	0.000603	0.01300	-0.155297	0.14498	-0.356*	20.932*	109.488*	0.131*
SLO	0.000855	0.01251	-0.110385	0.10070	0.184*	10.609*	53.666*	0.087*
TUR	0.001050	0.02284	-0.172500	0.17248	-0.630*	8.107*	69.601*	0.106*
AVG	0.000560	0.01574	-0.160080	0.14872	-0.267	16.336	69.984	0.099

The table details descriptive statistics for the nine sample countries over the 11 – year period, 1997 – 2007. The MEAN is the equally weighted average of the daily observations over the 11 – year time period. STDEV, MIN, MAX represent the standard deviation, minimum and maximum daily returns, respectively. SKEW is the Kendall – Stuart measure of skewness and KURT is the Kendall – Stuart measure of kurtosis. The table also shows the results from the Anderson – Darling (AD) and Kolmogorov – Smirnov (KS) tests for normality. * denotes significance at the 5 per cent level. The table based on returns denominated in local currency terms.

Table 4.2A
Results for the Filter Trading Strategy with Short Selling: Local Prices

	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
CRO										
NoT	1540.5	1268.5	1020.5	892.5	758.5	657.0	570.0	516.0	458.0	403.0
Net Ret.	-654.5	-591.4	-514.8	-534.9	-501.6	-447.8	-448.9	-450.1	-414.1	-338.5
B & H	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1
Diff.	-823.6	-760.5	-683.9	-704.1	-670.7	-616.9	-618.0	-619.2	-583.2	-507.7
CZE										
NoT	729.4	609.1	521.6	453.2	399.4	361.0	321.9	289.1	259.8	217.1
Net Ret.	158.7	201.1	220.9	239.6	257.2	257.0	284.9	303.4	326.7	342.5
B & H	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9
Diff.	-58.2	-15.7	4.0	22.7	40.3	40.1	68.0	86.5	109.8	125.6
EST										
NoT	1714.4	1461.6	1241.2	1057.2	896.4	774.8	688.4	622.4	555.2	510.8
Net Ret.	-1494.0	-1440.0	-1363.4	-1250.1	-1113.1	-1051.7	-971.7	-951.1	-876.0	-844.6
B & H	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0
Diff.	-1990.9	-1937.0	-1860.3	-1747.1	-1610.1	-1548.7	-1468.6	-1448.0	-1373.0	-1341.5
HUN										
NoT	1641.9	1370.6	1150.4	975.6	828.9	712.9	615.1	548.1	486.0	436.1
Net Ret.	-869.3	-804.9	-727.4	-650.6	-588.3	-512.4	-449.1	-444.1	-391.8	-350.8
B & H	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9
Diff.	-1307.2	-1242.8	-1165.3	-1088.4	-1026.1	-950.3	-886.9	-882.0	-829.7	-788.7
POL										
NoT	2007.7	1712.6	1447.3	1247.3	1081.3	945.6	837.8	751.9	669.2	607.0
Net Ret.	-309.8	-298.6	-243.2	-242.2	-225.9	-196.8	-206.9	-201.9	-176.5	-151.0
B & H	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
Diff.	-604.1	-592.9	-537.5	-536.6	-520.2	-491.1	-501.2	-496.2	-470.8	-445.4

The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the short selling filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.2A (continued)
Results for the Filter Trading Strategy with Short Selling: Local Prices

	6.0	7.0	8.0	9.0	10.0	12.0	14.0	16.0	18.0	20.0
CRO										
NoT	331.0	278.5	238.5	203.0	177.0	122.5	89.5	75.0	69.0	62.0
Net Ret.	-321.5	-298.6	-239.3	-196.7	-127.9	-7.6	107.7	66.0	64.6	29.6
B & H	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1
Diff.	-490.7	-467.7	-408.4	-365.8	-297.0	-176.7	-61.4	-103.1	-104.5	-139.5
CZE										
NoT	178.8	154.6	136.4	122.2	105.2	83.9	69.6	58.8	51.2	44.1
Net Ret.	305.9	305.4	297.3	299.2	271.7	265.6	309.4	304.8	306.8	385.5
B & H	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9
Diff.	89.0	88.6	80.4	82.3	54.8	48.7	92.5	87.9	89.9	168.6
EST										
NoT	414.8	358.0	309.6	276.8	251.2	200.4	151.2	117.2	98.8	85.2
Net Ret.	-636.3	-549.6	-437.7	-407.6	-383.2	-125.7	66.1	130.9	134.2	146.4
B & H	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0
Diff.	-1133.2	-1046.6	-934.6	-904.5	-880.1	-622.6	-430.9	-366.0	-362.8	-350.5
HUN										
NoT	358.4	303.1	263.4	227.5	204.1	164.0	130.9	110.9	91.9	79.1
Net Ret.	-305.9	-257.7	-254.0	-211.1	-191.2	-146.1	-76.6	-55.2	-16.8	-6.1
B & H	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9
Diff.	-743.8	-695.6	-691.8	-649.0	-629.1	-584.0	-514.5	-493.1	-454.7	-444.0
POL										
NoT	499.6	413.3	353.3	300.8	260.6	198.9	153.9	124.3	100.2	85.2
Net Ret.	-106.2	-62.6	-30.1	22.6	42.7	114.5	215.5	294.6	339.2	388.9
B & H	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
Diff.	-400.5	-356.9	-324.5	-271.7	-251.6	-179.9	-78.9	0.3	44.8	94.6

The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the short selling filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.2A (continued)
Results for the Filter Trading Strategy with Short Selling: Local Prices

	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
ROM										
NoT	1523.4	1406.3	1280.6	1153.1	1027.4	923.1	834.0	765.4	687.7	638.3
Net Ret.	-460.3	-500.5	-519.7	-463.5	-498.7	-462.5	-453.7	-422.7	-378.0	-365.9
B & H	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5
Diff.	-8949.8	-8990.0	-9009.2	-8953.1	-8988.3	-8952.0	-8943.2	-8912.2	-8867.5	-8855.5
RUS										
NoT	682.9	604.1	533.7	480.4	437.3	396.4	359.1	329.9	301.9	280.0
Net Ret.	387.0	412.6	416.4	457.8	461.0	446.2	458.1	446.2	400.4	412.1
B & H	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0
Diff.	-766.0	-740.4	-736.6	-695.2	-692.0	-706.9	-694.9	-706.8	-752.6	-740.9
SLO										
NoT	1794.0	1246.0	904.0	669.0	517.0	436.0	344.0	276.0	226.0	198.0
Net Ret.	-250.3	-159.7	-61.4	15.3	55.6	37.7	99.4	116.4	182.5	195.4
B & H	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7
Diff.	-1370.0	-1279.5	-1181.1	-1104.4	-1064.1	-1082.0	-1020.3	-1003.3	-937.2	-924.3
TUR										
NoT	2091.4	1869.2	1635.3	1407.6	1237.8	1094.2	972.0	869.0	775.9	702.7
Net Ret.	-506.2	-432.6	-343.4	-240.0	-163.2	-94.2	-42.5	17.0	61.6	113.7
B & H	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3
Diff.	-4622.4	-4548.8	-4459.6	-4356.3	-4279.4	-4210.5	-4158.8	-4099.3	-4054.7	-4002.5

The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the short selling filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.2A (continued)
Results for the Filter Trading Strategy with Short Selling: Local Prices

	6.0	7.0	8.0	9.0	10.0	12.0	14.0	16.0	18.0	20.0
ROM										
NoT	548.3	472.0	407.4	358.9	320.0	257.1	198.9	159.1	134.9	118.0
Net Ret.	-308.6	-218.9	-54.5	-13.7	49.2	92.7	280.1	426.1	503.3	688.9
B & H	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5
Diff.	-8798.2	-8708.5	-8544.1	-8503.2	-8440.4	-8396.8	-8209.4	-8063.4	-7986.3	-7800.6
RUS										
NoT	241.5	211.7	186.6	167.3	152.1	126.2	107.8	93.9	83.4	74.8
Net Ret.	414.9	409.1	431.8	454.3	441.4	454.9	440.4	460.9	479.4	485.3
B & H	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0
Diff.	-738.1	-744.0	-721.2	-698.7	-711.6	-698.1	-712.7	-692.1	-673.6	-667.7
SLO										
NoT	155.0	115.0	96.0	84.0	62.0	50.0	38.0	32.0	26.0	18.0
Net Ret.	167.6	255.3	242.3	239.0	311.6	269.1	270.7	227.2	232.4	288.7
B & H	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7
Diff.	-952.1	-864.5	-877.4	-880.7	-808.1	-850.7	-849.0	-892.6	-887.3	-831.0
TUR										
NoT	575.8	481.2	410.2	354.7	311.9	239.5	194.1	161.1	134.2	116.7
Net Ret.	195.1	281.3	359.3	401.2	437.6	499.9	521.4	515.1	606.1	588.6
B & H	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3
Diff.	-3921.2	-3835.0	-3756.9	-3715.1	-3678.6	-3616.4	-3594.9	-3601.2	-3510.2	-3527.7

The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the short selling filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.3A
Results for the Long – Only Filter Trading Strategy: Local Prices

	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
CRO										
NoT	770.5	634.5	510.5	446.5	379.5	328.5	285.0	258.0	229.0	201.5
Net Ret.	-280.2	-247.4	-206.7	-217.0	-200.5	-171.6	-173.3	-174.5	-159.1	-118.2
B & H	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1
Diff.	-449.3	-416.5	-375.8	-386.1	-369.6	-340.7	-342.4	-343.6	-328.2	-287.3
CZE										
NoT	365.1	304.9	261.2	227.0	200.1	180.9	161.4	145.0	130.4	109.1
Net Ret.	112.2	136.0	145.1	154.3	163.6	162.5	176.1	185.4	194.2	220.1
B & H	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9
Diff.	-104.6	-80.9	-71.8	-62.6	-53.3	-54.4	-40.8	-31.5	-22.7	3.2
EST										
NoT	857.2	730.8	620.8	528.8	448.4	387.6	344.8	311.2	277.6	255.6
Net Ret.	-669.5	-637.2	-600.1	-544.2	-475.4	-446.3	-406.0	-401.8	-360.2	-341.5
B & H	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0
Diff.	-1166.5	-1134.2	-1097.1	-1041.1	-972.3	-943.3	-902.9	-898.7	-857.2	-838.4
HUN										
NoT	821.5	685.9	575.7	488.2	414.9	356.8	307.9	274.4	243.3	218.4
Net Ret.	-373.3	-325.2	-286.4	-248.0	-221.1	-181.1	-148.2	-149.2	-125.7	-102.6
B & H	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9
Diff.	-811.2	-763.1	-724.3	-685.9	-659.0	-619.0	-586.1	-587.1	-563.6	-540.5
POL										
NoT	1004.1	856.6	723.9	623.9	541.0	473.1	419.3	376.3	335.0	303.9
Net Ret.	-105.3	-99.5	-72.1	-70.8	-60.5	-44.8	-49.5	-45.9	-33.6	-20.7
B & H	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
Diff.	-399.7	-393.9	-366.4	-365.2	-354.9	-339.1	-343.9	-340.3	-327.9	-315.0

The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the long – only filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.3A (continued)
Results for the Long – Only Filter Trading Strategy: Local Prices

	6.0	7.0	8.0	9.0	10.0	12.0	14.0	16.0	18.0	20.0
CRO										
NoT	165.5	139.5	119.5	102.0	89.0	62.0	45.5	38.0	35.0	31.5
Net Ret.	-107.8	-97.4	-64.7	-29.4	-1.5	66.6	113.1	62.4	79.5	59.5
B & H	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1
Diff.	-276.9	-266.5	-233.8	-198.6	-170.7	-102.6	-56.0	-106.7	-89.7	-109.6
CZE										
NoT	90.0	77.9	68.7	61.6	53.0	42.3	35.1	29.7	25.9	22.3
Net Ret.	206.4	205.2	204.2	203.8	183.9	180.1	186.6	202.6	208.8	303.4
B & H	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9
Diff.	-10.4	-11.7	-12.7	-13.1	-33.0	-36.8	-30.3	-14.3	-8.1	86.5
EST										
NoT	207.6	179.2	155.2	138.8	126.0	100.4	76.0	59.2	50.0	43.2
Net Ret.	-255.4	-210.6	-169.1	-158.6	-141.3	-71.0	41.9	89.3	94.9	102.9
B & H	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0
Diff.	-752.4	-707.5	-666.0	-655.5	-638.2	-568.0	-455.1	-407.7	-402.1	-394.0
HUN										
NoT	179.7	152.1	132.0	114.0	102.4	82.4	65.9	56.1	46.5	40.1
Net Ret.	-81.3	-55.2	-53.2	-29.6	-15.3	5.3	44.1	55.7	74.6	76.7
B & H	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9
Diff.	-519.2	-493.1	-491.1	-467.5	-453.2	-432.6	-393.8	-382.2	-363.3	-361.2
POL										
NoT	250.2	207.1	177.3	151.0	131.0	100.1	77.6	62.8	50.8	43.2
Net Ret.	3.9	25.2	42.6	71.5	82.6	115.1	173.0	237.1	263.8	309.2
B & H	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
Diff.	-290.4	-269.1	-251.8	-222.9	-211.7	-179.2	-121.4	-57.2	-30.5	14.8

The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the long – only filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.3A (continued)
Results for the Long – Only Filter Trading Strategy: Local Prices

	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
ROM										
NoT	762.0	703.4	640.6	576.9	514.0	462.0	417.4	383.1	344.3	319.4
Net Ret.	-53.7	-73.0	-80.6	-54.9	-73.1	-47.9	-45.8	-30.6	-6.6	1.4
B & H	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5
Diff.	-8543.2	-8562.6	-8570.2	-8544.4	-8562.6	-8537.4	-8535.4	-8520.1	-8496.1	-8488.1
RUS										
NoT	342.0	302.5	267.4	240.8	219.2	198.7	180.1	165.4	151.4	140.5
Net Ret.	249.1	262.7	263.9	295.2	297.9	288.4	292.1	288.6	268.1	272.4
B & H	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0
Diff.	-903.9	-890.3	-889.2	-857.8	-855.1	-864.6	-860.9	-864.4	-884.9	-880.6
SLO										
NoT	897.0	623.0	452.0	335.0	259.0	219.0	173.0	139.0	114.0	100.0
Net Ret.	2.5	49.6	99.5	138.3	159.3	150.5	182.1	194.3	227.3	236.0
B & H	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7
Diff.	-1117.2	-1070.1	-1020.2	-981.5	-960.4	-969.3	-937.7	-925.4	-892.5	-883.8
TUR										
NoT	1046.4	935.2	818.2	704.3	619.4	547.6	486.6	435.1	388.6	352.0
Net Ret.	-92.3	-55.1	-9.2	43.4	82.3	117.8	146.0	176.1	201.1	230.6
B & H	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3
Diff.	-4208.6	-4171.4	-4125.5	-4072.9	-4034.0	-3998.5	-3970.2	-3940.2	-3915.1	-3885.7

The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the long – only filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.3A (continued)
Results for the Long – Only Filter Trading Strategy: Local Prices

	6.0	7.0	8.0	9.0	10.0	12.0	14.0	16.0	18.0	20.0
ROM										
NoT	274.6	236.3	204.0	179.7	160.3	128.9	99.7	79.7	67.7	59.1
Net Ret.	30.6	73.7	160.8	187.0	217.8	258.0	362.0	492.0	521.2	688.6
B & H	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5
Diff.	-8458.9	-8415.9	-8328.8	-8302.5	-8271.7	-8231.6	-8127.5	-7997.5	-7968.3	-7801.0
RUS										
NoT	121.2	106.3	93.7	84.0	76.4	63.4	54.2	47.2	41.9	37.7
Net Ret.	277.2	289.4	303.4	310.4	295.6	323.1	314.1	328.1	350.6	339.8
B & H	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0
Diff.	-875.8	-863.7	-849.6	-842.6	-857.5	-829.9	-839.0	-824.9	-802.4	-813.2
SLO										
NoT	78.0	58.0	48.0	42.0	31.0	25.0	19.0	17.0	14.0	10.0
Net Ret.	229.8	294.7	285.4	290.3	332.4	307.6	306.2	277.3	284.3	327.2
B & H	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7
Diff.	-890.0	-825.0	-834.3	-829.4	-787.4	-812.1	-813.5	-842.4	-835.4	-792.6
TUR										
NoT	288.6	241.3	205.8	178.0	156.6	120.4	97.7	81.0	67.6	58.8
Net Ret.	279.5	331.8	375.5	405.1	429.7	469.2	488.4	492.0	586.7	585.3
B & H	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3
Diff.	-3836.8	-3784.4	-3740.8	-3711.1	-3686.6	-3647.1	-3627.9	-3624.3	-3529.6	-3530.9

The table details the number of trades (NoT) and the net return (Net Ret.) from following the filter strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the long – only filter strategy and the corresponding buy – and – hold strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.4A
The Moving Average Results Over The Short – Long Average Period Of 1, 2 And 5 Day(s): Local Prices

Country	Short Run 1				Short Run 2				Short Run 5			
	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff
CRO	224.0	-50.0	169.1	-219.15	119.0	-78.3	169.1	-247.47	104.5	77.	169.1	-91.7
CZE	106.1	323.9	216.8	107.0	71.	84.	216.8	-132.83	66.	73.	216.8	-143.50
EST	246.5	61.	496.9	-435.31	123.8	20.	496.9	-476.75	91.	79.	496.9	-417.35
HUN	221.5	-289.66	437.8	-727.53	116.5	81.	437.8	-356.26	109.2	120.2	437.8	-317.64
POL	222.3	469.1	294.3	174.8	110.5	25.	294.3	-269.09	88.	-28.9	294.3	-323.31
ROM	182.1	718.0	8489.53	-7771.49	101.4	-64.4	8489.53	-8553.94	82.	51.	1129.98	-1078.52
RUS	101.5	955.0	1153.03	-197.94	61.	99.	1153.03	-1053.74	60.	239.5	1153.03	-913.46
SLO	177.6	224.9	1119.72	-894.82	80.	-65.8	1119.72	-1185.57	84.	-101.34	1119.72	-1221.06
TUR	230.9	327.0	4116.26	-3789.19	123.3	252.1	4116.26	-3864.09	99.	434.7	4116.26	-3681.53
AVG	194.7	392.7	2632.48	-2239.72	105.4	166.6	2663.16	-2496.57	89.	286.3	2632.48	-2346.14

The table details the Number of Trades (NoT), the Net Return (Net Ret.) from the following filter strategy, the Buy and Hold return (B & H) and the difference (Diff.) in profits from following the short – long moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.5A
The Moving Average Results Over The Short – Long Average Period Of 50, 150 And 200 Day(s): Local Prices

	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff
CRO	338.0	-84.5	169.1	-253.69	142.0	21.	169.1	-147.94	136.7	-54.4	169.1	-223.56
CZE	161.9	316.0	216.8	99.	76.	165.7	216.8	-51.1	70.	240.9	216.8	24.
EST	358.0	-157.91	496.9	-654.86	148.7	176.3	496.9	-320.57	149.5	44.	496.9	-452.01
HUN	317.2	-351.98	437.8	-789.85	145.0	-68.0	437.8	-505.89	141.5	-89.5	437.8	-527.43
POL	357.3	201.8	294.3	-92.4	131.5	264.8	294.3	-29.5	122.8	336.1	294.3	41.
ROM	311.4	593.8	1129.98	-536.17	116.7	568.9	1129.98	-561.08	106.7	862.4	1129.98	-267.58
RUS	151.1	658.1	1153.03	-494.92	72.	907.1	1153.03	-245.93	65.	365.8	1153.03	-787.13
SLO	300.0	131.9	1119.72	-987.78	106.0	90.	1119.72	-1029.41	92.	97.	1119.72	-1022.25
TUR	341.9	410.0	4116.26	-3706.19	144.0	372.9	4116.26	-3743.36	142.7	256.1	4116.26	-3860.13
AVG	291.2	349.6	2632.48	-2282.85	123.7	390.1	2632.48	-2242.33	120.3	249.5	2636.78	-2387.20

The table details the Number of Trades (NoT), the Net Return (Net Ret.) from the following filter strategy, the Buy and Hold return (B & H) and the difference (Diff.) in profits from following the short – long moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.6A
The Moving Average Results Over The Short – Long Average Period Of The Bandwidth 0 and 1 Day(s): Local Prices

Country	Bandwidth 0				Bandwidth 1			
	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff
CRO	206.20	-43.89	169.12	-213.00	152.00	-16.56	169.12	-185.67
CZE	100.79	231.78	216.89	14.89	81.92	219.98	216.89	3.09
EST	212.48	37.15	496.96	-459.80	169.28	76.74	496.96	-420.21
HUN	198.00	-139.65	437.88	-577.52	158.13	-127.20	437.88	-565.08
POL	194.01	273.89	294.35	-20.46	152.49	287.61	294.35	-6.74
ROM	166.69	685.83	1129.98	-444.15	136.69	696.73	1129.98	-433.25
RUS	92.02	648.90	1153.03	-504.12	78.47	632.73	1153.03	-520.29
SLO	171.60	94.28	1119.72	-1025.45	107.20	108.74	1119.72	-1010.99
TUR	200.81	341.12	4116.26	-3775.14	165.47	326.14	4116.26	-3790.12
AVG	169.25	274.07	2121.11	-1847.04	137.53	269.88	2121.11	-1851.23

The table details the Number of Trades (NoT), the Net Return (Net Ret.) from the following filter strategy, the Buy and Hold return (B & H) and the difference (Diff.) in profits from following the short – long moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.7A
The Moving Average Results Over The Long – Only Average Period Of 1, 2 And 5 Day(s): Local Prices

	Short Run 1				Short Run 2				Short Run 5			
	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff
CRO	112.42	88.80	169.12	-80.32	60.25	10.86	169.12	-158.26	52.75	76.49	169.12	-92.63
CZE	53.42	231.59	216.89	14.70	36.41	86.48	216.89	-130.41	33.85	83.70	216.89	-133.19
EST	123.60	-70.10	496.96	-567.06	62.40	78.28	496.96	-418.67	46.20	104.01	496.96	-392.94
HUN	111.39	-89.74	437.88	-527.62	59.21	58.33	437.88	-379.55	55.43	68.46	437.88	-369.42
POL	112.05	312.80	294.35	18.45	55.74	39.44	294.35	-254.90	44.44	14.33	294.35	-280.02
ROM	91.52	573.02	8489.53	-7916.51	51.57	24.88	8489.53	-8464.65	42.29	41.13	8489.53	-8448.40
RUS	51.05	601.03	1153.03	-551.99	31.24	100.79	1153.03	-1052.24	30.83	210.34	1,153.03	-942.69
SLO	89.67	284.50	1119.72	-835.22	41.00	43.73	1119.72	-1076.00	42.50	28.18	1119.72	-1091.54
TUR	116.06	397.11	4116.26	-3719.15	62.33	226.79	4116.26	-3889.47	50.58	385.81	4116.26	-3730.45
AVG	97.92	362.83	2632.48	-2269.65	53.40	156.09	2663.16	-2507.07	45.33	257.78	2632.48	-2374.70

The table details the Number of Trades (NoT), the Net Return (Net Ret.) from the following filter strategy, the Buy and Hold return (B & H) and the difference (Diff.) in profits from following the long – only moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.8A
The Moving Average Results Over The Short – Long Average Period Of 50, 150 And 200 Day(s): Local Prices

	Long Run 50				Long Run 150				Long Run 200			
	NoT	**Rule**	**B & H**	**Diff**	**NoT**	**Rule**	**B & H**	**Diff**	**NoT**	**Rule**	**B & H**	**Diff**
CRO	169.25	32.02	169.12	-137.10	71.50	91.22	169.12	-77.90	69.00	69.64	169.12	-99.48
CZE	81.35	191.02	216.89	-25.87	38.69	140.05	216.89	-76.84	35.90	196.91	216.89	-19.98
EST	179.20	-130.52	496.96	-627.47	74.90	33.91	496.96	-463.04	75.20	17.34	496.96	-479.62
HUN	159.21	-101.68	437.88	-539.55	73.23	-4.75	437.88	-442.63	71.57	-15.64	437.88	-453.51
POL	179.41	167.58	294.35	-126.76	66.31	200.71	294.35	-93.63	62.15	211.57	294.35	-82.77
ROM	154.29	390.68	8489.53	-8098.85	54.79	237.46	8489.53	-8252.07	52.29	459.73	8489.53	-8029.80
RUS	75.92	396.06	1153.03	-756.97	36.47	657.31	1153.03	-495.71	33.18	201.77	1153.03	-951.25
SLO	150.50	226.75	1119.72	-892.98	53.75	175.95	1119.72	-943.77	47.25	173.38	1119.72	-946.34
TUR	171.70	448.25	4116.26	-3668.02	72.70	389.28	4116.26	-3726.98	72.00	288.57	4116.26	-3827.70
AVG	146.20	334.41	2632.48	-2298.07	62.48	351.86	2632.48	-2280.62	60.75	231.37	2636.78	-2405.41

The table details the Number of Trades (NoT), the Net Return (Net Ret.) from the following filter strategy, the Buy and Hold return (B & H) and the difference (Diff.) in profits from following the long – only moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.9A
The Moving Average Results Over The Short – Long Average Period Of The Bandwidth 0 and 1 Day(s): Local Prices

Country	Bandwidth 0				Bandwidth 1			
	NoT	Rule	B & H	Diff	NoT	Rule	B & H	Diff
CRO	103.60	67.06	169.12	-102.06	76.50	74.44	169.12	-94.68
CZE	50.73	177.47	216.89	-39.42	41.48	168.51	216.89	-48.38
EST	106.64	-14.93	496.96	-511.89	85.12	3.73	496.96	-493.23
HUN	99.71	-26.78	437.88	-464.66	79.81	-30.20	437.88	-468.08
POL	97.64	195.13	294.35	-99.22	76.89	201.73	294.35	-92.61
ROM	79.37	356.50	8489.53	-8133.03	68.00	357.53	8489.53	-8132.00
RUS	46.36	462.09	1153.03	-690.93	39.72	383.60	1153.03	-769.43
SLO	86.60	182.23	1119.72	-937.49	54.40	187.93	1119.72	-931.79
TUR	101.04	370.37	4116.26	-3745.89	83.40	351.20	4116.26	-3765.06
AVG	85.18	258.43	2121.11	-1862.68	69.38	241.41	2121.11	-1879.70

The table details the Number of Trades (NoT), the Net Return (Net Ret.) from the following filter strategy, the Buy and Hold return (B & H) and the difference (Diff.) in profits from following the long – only moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each filter rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.10A
The Number of Companies that Outperformed the Buy and Hold Strategy for the Short – Long Filter Trading Strategy: Local Prices.

	0.5		1.0		1.5		2.0		2.5		3.0		3.5		4.0		4.5		5.0	
	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
CRO	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0
CZE	17	17	16	18	16	18	16	18	14	20	14	20	14	20	14	20	13	21	12	22
EST	5	0	5	0	5	0	4	1	4	1	4	1	4	1	4	1	4	1	4	1
HUN	26	2	26	2	26	2	26	2	27	1	26	2	26	2	26	2	24	4	23	5
POL	26	1	26	1	24	3	24	3	24	3	24	3	23	4	23	4	21	6	21	6
ROM	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0
RUS	45	14	43	16	43	16	43	16	43	16	44	15	42	17	42	17	43	16	42	17
SLO	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0
TUR	183	4	181	6	181	6	180	7	178	9	178	9	176	11	175	12	174	13	174	13

The table details the short – long filter strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each company which outperformed the buy and hold strategy. The "Y" represents the number of companies that outperformed the buy – and – hold strategy and the "N" accounts for the number of companies that did not outperform the buy – and – hold strategy. The trading rules were implemented using share prices denominated in local currency.

Table 4.10A (continued)
The Number of Companies that Outperformed the Buy and Hold Strategy for the Short – Long Filter Trading Strategy: Local Prices.

	6.0		7.0		8.0		9.0		10.0		12.0		14.0		16.0		18.0		20.0	
	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
CRO	4	0	4	0	4	0	4	0	4	0	4	0	3	1	4	0	3	1	3	1
CZE	13	21	14	20	14	20	15	19	15	19	13	21	14	20	15	19	17	17	18	16
EST	4	1	4	1	4	1	4	1	4	1	3	2	3	2	3	2	3	2	3	2
HUN	24	4	23	5	23	5	23	5	23	5	23	5	22	6	22	6	20	8	19	9
POL	21	6	19	8	20	7	18	9	18	9	17	10	14	13	14	13	13	14	12	15
ROM	7	0	6	1	5	2	5	2	5	2	6	1	5	2	5	2	5	2	6	1
RUS	42	17	44	15	44	15	43	16	44	15	42	17	43	16	42	17	45	14	43	16
SLO	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0
TUR	169	18	169	18	165	22	162	25	162	25	157	30	157	30	158	29	155	32	162	25

The table details the short – long filter strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each company which outperformed the buy and hold strategy. The "Y" represents the number of companies that outperformed the buy – and – hold strategy and the "N" accounts for the number of companies that did not outperform the buy – and – hold strategy. The trading rules were implemented using share prices denominated in local currency.

Table 4.11A
The Number of Companies that Outperformed the Buy and Hold Strategy for the Long – Only Filter Trading Strategy: Local Prices.

	0.5		1.0		1.5		2.0		2.5		3.0		3.5		4.0		4.5		5.0	
	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
CRO	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0
CZE	18	16	17	17	17	17	17	17	16	18	16	18	14	20	15	19	15	19	15	19
EST	5	0	5	0	5	0	4	1	4	1	4	1	4	1	4	1	4	1	4	1
HUN	26	2	26	2	26	2	26	2	26	2	26	2	25	3	26	2	23	5	22	6
POL	26	1	25	2	23	4	23	4	23	4	23	4	24	3	24	3	22	5	23	4
ROM	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0	7	0
RUS	47	12	47	12	47	12	46	13	45	14	45	14	43	16	44	15	44	15	45	14
SLO	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0
TUR	183	4	182	5	182	5	182	5	180	7	181	6	179	8	178	9	177	10	176	11

The table details the long – only filter strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each company which outperformed the buy and hold strategy. The "Y" represents the number of companies that outperformed the buy – and – hold strategy and the "N" accounts for the number of companies that did not outperform the buy – and – hold strategy. The trading rules were implemented using share prices denominated in local currency.

Table 4.11A (continued)
The Number of Companies that Outperformed the Buy and Hold Strategy for the Long – Only Filter Trading Strategy: Local Prices.

	6.0		7.0		8.0		9.0		10.0		12.0		14.0		16.0		18.0		20.0	
	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
CRO	4	0	4	0	4	0	4	0	4	0	4	0	3	1	4	0	3	1	3	1
CZE	17	17	17	17	16	18	15	19	15	19	16	18	15	19	18	16	18	16	22	12
EST	4	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1	4	1
HUN	24	4	24	4	23	5	23	5	23	5	22	6	22	6	21	7	20	8	20	8
POL	21	6	20	7	20	7	18	9	17	10	17	10	14	13	15	12	14	13	13	14
ROM	7	0	7	0	6	1	6	1	6	1	6	1	6	1	5	2	6	1	6	1
RUS	45	14	44	15	45	14	45	14	45	14	45	14	46	13	46	13	47	12	48	11
SLO	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0
TUR	172	15	171	16	169	18	168	19	165	22	167	20	166	21	163	24	161	26	161	26

The table details the long – only filter strategy for each of the 20 filter rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each company which outperformed the buy and hold strategy. The "Y" represents the number of companies that outperformed the buy – and – hold strategy and the "N" accounts for the number of companies that did not outperform the buy – and – hold strategy. The trading rules were implemented using share prices denominated in local currency.

Table 4.12A
The Number of Companies that Outperformed the Buy and Hold Strategy for the Short – Long Moving Average Trading Strategy: Local Prices

	(1, 50, 0)		(1, 50, 1)		(1, 150, 0)		(1, 150, 1)		(5, 150, 0)		(5, 150, 1)		(1, 200, 0)		(1, 200, 1)		(2, 200, 0)		(2, 200, 1)	
	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
CRO	4	0	4	0	4	0	4	0	3	1	3	1	4	0	4	0	4	0	4	0
CZE	13	21	14	20	18	16	20	14	21	13	21	13	19	15	19	15	20	14	20	14
EST	4	1	4	1	3	2	3	2	4	1	3	2	3	2	3	2	3	2	3	2
HUN	25	3	25	3	23	5	23	5	22	6	22	6	25	3	23	5	19	9	19	9
POL	15	12	13	14	12	15	12	15	24	3	24	3	11	16	12	15	22	5	22	5
ROM	5	2	5	2	5	2	5	2	7	0	7	0	5	2	5	2	7	0	7	0
RUS	33	26	37	22	34	25	33	26	42	17	42	17	32	27	34	25	50	9	47	12
SLO	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0
TUR	166	21	163	24	169	18	170	17	166	21	165	22	173	14	172	15	169	18	169	18

The table details the short – long only filter strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each company which outperformed the buy and hold strategy. The "Y" represents the number of companies that outperformed the buy – and – hold strategy and the "N" accounts for the number of companies that did not outperform the buy – and – hold strategy. The trading rules were implemented using share prices denominated in local currency.

Table 4.13A
The Number of Companies that Outperformed the Buy and Hold Strategy for the Long – Only Moving Average Trading Strategy: Local Prices

	(1, 50, 0)		(1, 50, 1)		(1, 150, 0)		(1, 150, 1)		(5, 150, 0)		(5, 150, 1)		(1, 200, 0)		(1, 200, 1)		(2, 200, 0)		(2, 200, 1)	
	Y	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
CRO	4	0	4	0	4	0	3	1	3	1	3	1	3	1	2	2	4	0	4	0
CZE	17	17	18	16	18	16	19	15	21	13	23	11	18	16	21	13	22	12	21	13
EST	4	1	4	1	4	1	4	1	4	1	4	1	5	0	5	0	4	1	4	1
HUN	25	3	25	3	25	3	25	3	22	6	23	5	25	3	25	3	23	5	23	5
POL	15	12	14	13	15	12	13	14	23	4	23	4	13	14	13	14	21	6	20	7
ROM	6	1	6	1	6	1	6	1	7	0	7	0	6	1	6	1	7	0	7	0
RUS	41	18	43	16	47	12	49	10	41	18	41	18	51	8	52	7	48	11	47	12
SLO	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0
TUR	172	15	170	17	172	15	173	14	172	15	172	15	175	12	175	12	175	12	176	11

The table details the long – only filter strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. In particular, the table shows the results for each company which outperformed the buy and hold strategy. The "Y" represents the number of companies that outperformed the buy – and – hold strategy and the "N" accounts for the number of companies that did not outperform the buy – and – hold strategy. The trading rules were implemented using share prices denominated in local currency.

Table 4.14A
Results for the Moving Average Trading Strategy with Short Selling: Sterling Prices

	(1, 50, 0)	(1, 50, 1)	(1, 150, 0)	(1, 150, 1)	(5, 150, 0)	(5, 150, 1)	(1, 200, 0)	(1, 200, 1)	(2, 200, 0)	(2, 200, 1)
CRO										
NoT	433.0	308.0	228.0	166.0	117.5	95.5	191.5	143.5	149.5	115.5
Net Ret.	-188.2	-162.7	-176.4	-126.8	56.9	80.5	-137.5	-117.8	-93.2	-59.4
B & H	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8
Diff.	-340.0	-314.5	-328.2	-278.6	-95.0	-71.3	-289.3	-269.6	-245.0	-211.2
CZE										
NoT	295.1	197.5	157.8	101.4	93.4	75.2	137.5	87.9	105.8	77.6
Net Ret.	299.0	309.0	385.2	400.6	90.4	104.1	413.2	478.1	69.4	76.8
B & H	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4
Diff.	-9.4	0.6	76.7	92.2	-218.0	-204.4	104.8	169.7	-239.0	-231.6
EST										
NoT	439.6	330.8	220.8	177.6	118.4	91.2	178.4	141.6	148.4	120.4
Net Ret.	-245.2	-190.1	298.1	330.3	27.7	17.8	174.3	192.4	106.5	77.8
B & H	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0
Diff.	-735.1	-680.1	-191.9	-159.7	-462.3	-472.2	-315.7	-297.6	-383.5	-412.1
HUN										
NoT	389.0	292.9	226.9	176.3	122.2	103.4	191.9	153.7	150.6	121.2
Net Ret.	-305.8	-261.8	-293.3	-249.0	159.5	233.6	-281.9	-253.9	140.4	291.4
B & H	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9
Diff.	-637.7	-593.7	-625.3	-580.9	-172.5	-98.4	-613.8	-585.9	-191.5	-40.6
POL										
NoT	412.4	319.9	223.4	176.0	106.8	90.2	161.8	127.9	120.9	100.1
Net Ret.	204.0	244.5	439.1	468.1	20.1	22.1	598.3	598.6	44.0	45.2
B & H	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
Diff.	-90.3	-49.8	144.8	173.8	-274.2	-272.2	304.0	304.2	-250.3	-249.1

Table 4.14A (continued)
Results for the Moving Average Trading Strategy with Short Selling: Sterling Prices

	(1, 50, 0)	(1, 50, 1)	(1, 150, 0)	(1, 150, 1)	(5, 150, 0)	(5, 150, 1)	(1, 200, 0)	(1, 200, 1)	(2, 200, 0)	(2, 200, 1)
ROM										
NoT	344.9	278.0	169.4	133.4	86.3	78.0	127.4	100.0	105.4	94.0
Net Ret.	548.2	639.4	1092.2	1080.4	48.5	54.4	1695.2	1668.6	44.9	40.9
B & H	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0
Diff.	-581.7	-490.6	-37.8	-49.5	-1081.4	-1075.6	565.2	538.6	-1085.0	-1089.1
RUS										
NoT	312.4	200.9	148.2	95.9	84.8	69.5	122.6	82.9	96.7	75.2
Net Ret.	1384.5	1454.3	3703.0	3646.9	2056.2	2090.0	2415.6	2418.1	96.4	111.3
B & H	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2
Diff.	1240.3	1310.0	3558.8	3502.6	1912.0	1945.8	2271.4	2273.9	-47.8	-32.9
SLO										
NoT	378.0	234.0	154.0	94.0	88.0	74.0	114.0	80.0	110.0	82.0
Net Ret.	117.6	149.0	286.3	293.0	-26.3	-38.5	274.2	280.7	-88.7	-69.0
B & H	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0
Diff.	-669.3	-638.0	-500.7	-494.0	-813.3	-825.4	-512.8	-506.2	-875.7	-856.0
TUR										
NoT	372.4	303.9	208.4	169.2	107.9	104.4	178.3	149.8	135.7	115.9
Net Ret.	418.8	432.5	314.8	323.0	364.4	358.8	268.3	260.6	167.9	161.7
B & H	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8
Diff.	183.0	196.7	79.0	87.2	128.6	123.0	32.5	24.8	-67.9	-74.1

The table details the number of trades (NoT) and the net return (Net Ret.) from following the moving average strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the short selling moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each moving average rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling. All returns are expressed in percentages.

Table 4.15A
Results for the Long – Only Moving Average Trading Strategy: Sterling Prices

	(1, 50, 0)	(1, 50, 1)	(1, 150, 0)	(1, 150, 1)	(5, 150, 0)	(5, 150, 1)	(1, 200, 0)	(1, 200, 1)	(2, 200, 0)	(2, 200, 1)
CRO										
NoT	216.5	154.0	114.0	83.0	59.5	48.5	96.0	72.0	75.5	58.5
Net Ret.	-46.1	-41.0	-1.1	25.5	85.7	94.8	46.2	55.4	10.2	21.6
B & H	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8	151.8
Diff.	-197.9	-192.8	-152.9	-126.4	-66.1	-57.0	-105.6	-96.5	-141.6	-130.2
CZE										
NoT	147.6	98.9	79.0	50.8	47.6	38.5	68.8	44.1	53.8	39.6
Net Ret.	189.0	194.7	356.6	363.4	106.0	110.1	387.8	394.7	90.6	92.1
B & H	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4	308.4
Diff.	-119.4	-113.8	48.2	54.9	-202.4	-198.3	79.4	86.3	-217.8	-216.3
EST										
NoT	220.0	165.6	110.8	89.2	60.0	46.4	89.6	71.2	74.8	60.8
Net Ret.	-161.0	-138.2	-38.5	-18.9	83.6	77.3	29.3	36.4	108.3	91.6
B & H	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0	490.0
Diff.	-651.0	-628.2	-528.5	-508.9	-406.4	-412.6	-460.6	-453.5	-381.6	-398.4
HUN										
NoT	194.8	146.8	114.0	88.7	62.1	52.6	96.3	77.2	76.2	61.6
Net Ret.	-113.1	-93.5	-98.1	-79.7	72.5	107.3	-108.7	-95.4	81.3	147.5
B & H	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9	331.9
Diff.	-445.0	-425.5	-430.0	-411.7	-259.5	-224.7	-440.6	-427.3	-250.6	-184.4
POL										
NoT	206.7	160.5	112.4	88.7	53.6	45.3	81.5	64.5	61.0	50.6
Net Ret.	161.2	178.2	319.2	320.3	43.5	42.0	349.9	345.5	49.2	49.3
B & H	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
Diff.	-133.1	-116.1	24.9	26.0	-250.8	-252.3	55.5	51.2	-245.1	-245.0

Table 4.15A (continued)
Results for the Long – Only Moving Average Trading Strategy: Sterling Prices.

	(1, 50, 0)	(1, 50, 1)	(1, 150, 0)	(1, 150, 1)	(5, 150, 0)	(5, 150, 1)	(1, 200, 0)	(1, 200, 1)	(2, 200, 0)	(2, 200, 1)
ROM										
NoT	172.9	139.4	85.4	67.4	43.7	39.7	64.3	50.6	53.7	48.0
Net Ret.	341.1	387.3	316.5	321.3	25.9	24.2	941.5	939.8	57.2	53.7
B & H	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0	1130.0
Diff.	-788.9	-742.7	-813.5	-808.7	-1104.0	-1105.7	-188.5	-190.2	-1072.8	-1076.3
RUS										
NoT	156.4	100.6	74.2	48.0	43.2	35.6	61.5	41.6	48.9	38.1
Net Ret.	307.4	296.6	916.6	916.9	2006.9	2004.4	208.7	207.2	69.7	73.3
B & H	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2	144.2
Diff.	163.2	152.4	772.4	772.6	1862.6	1860.1	64.5	63.0	-74.5	-70.9
SLO										
NoT	189.0	117.0	78.0	48.0	45.0	38.0	57.0	40.0	56.0	42.0
Net Ret.	197.4	212.3	307.6	306.8	43.5	34.4	293.3	295.6	17.1	26.8
B & H	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0	787.0
Diff.	-589.6	-574.6	-479.4	-480.1	-743.5	-752.5	-493.7	-491.4	-769.8	-760.2
TUR										
NoT	186.4	152.2	104.2	84.9	54.8	53.1	89.4	75.5	68.4	58.8
Net Ret.	238.5	242.1	173.2	175.3	215.3	211.3	136.7	132.7	95.6	91.2
B & H	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8	235.8
Diff.	2.7	6.3	-62.6	-60.5	-20.5	-24.5	-99.1	-103.1	-140.2	-144.6

The table details the number of trades (NoT) and the net return (Net Ret.) from following the moving average strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the long – only moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each moving average rule averaged over the individual companies. The trading rules were implemented using share prices denominated in sterling. All returns are expressed in percentages.

Table 4.16A
Results for the Moving Average Trading Strategy with Short Selling: Local Prices

	(1, 50, 0)	(1, 50, 1)	(1, 150, 0)	(1, 150, 1)	(5, 150, 0)	(5, 150, 1)	(1, 200, 0)	(1, 200, 1)	(2, 200, 0)	(2, 200, 1)
CRO										
NoT	396.5	279.5	210.0	149.0	116.0	93.0	174.0	135.0	134.5	103.5
Net Ret.	-104.9	-64.2	-52.0	-18.0	63.8	90.9	-43.3	-17.7	-83.0	-73.7
B & H	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1
Diff.	-274.0	-233.4	-221.1	-187.1	-105.3	-78.2	-212.5	-186.9	-252.1	-242.8
CZE										
NoT	181.3	142.5	96.3	76.5	72.4	60.9	75.8	64.5	78.2	65.1
Net Ret.	326.2	305.8	266.8	249.3	75.5	71.3	406.1	389.6	84.3	83.8
B & H	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9
Diff.	109.3	88.9	49.9	32.4	-141.4	-145.6	189.2	172.7	-132.6	-133.1
EST										
NoT	394.0	322.0	229.6	183.2	101.2	80.8	200.8	149.6	136.8	110.8
Net Ret.	-172.1	-143.7	252.7	293.6	56.5	102.7	34.9	104.5	13.8	26.6
B & H	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0
Diff.	-669.0	-640.7	-244.3	-203.3	-440.5	-394.3	-462.1	-392.5	-483.2	-470.3
HUN										
NoT	355.3	279.1	203.1	158.4	119.7	98.7	185.0	148.1	126.9	106.2
Net Ret.	-359.2	-344.7	-261.9	-250.7	128.7	111.7	-280.1	-241.4	74.2	89.0
B & H	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9
Diff.	-797.1	-782.6	-699.7	-688.6	-309.1	-326.1	-717.9	-679.3	-363.7	-348.8
POL										
NoT	404.4	310.2	197.6	151.3	95.4	82.0	149.9	120.4	122.7	98.5
Net Ret.	175.0	228.7	548.2	569.1	-32.6	-25.3	650.6	643.2	28.2	22.3
B & H	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
Diff.	-119.3	-65.6	253.8	274.7	-327.0	-319.7	356.3	348.9	-266.1	-272.0

Table 4.16A (continued)
Results for the Moving Average Trading Strategy with Short Selling: Local Prices

	(1, 50, 0)	(1, 50, 1)	(1, 150, 0)	(1, 150, 1)	(5, 150, 0)	(5, 150, 1)	(1, 200, 0)	(1, 200, 1)	(2, 200, 0)	(2, 200, 1)
ROM										
NoT	335.7	279.7	144.0	122.9	89.7	77.1	110.6	99.7	108.0	94.9
Net Ret.	318.3	369.2	694.6	695.9	-7.2	-15.3	1112.9	1117.4	-69.4	-59.4
B & H	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5
Diff.	-8171.2	-8120.3	-7795.0	-7793.7	-8496.7	-8504.8	-7376.6	-7372.2	-8558.9	-8548.9
RUS										
NoT	165.9	136.4	89.7	77.7	64.1	56.6	74.4	64.9	66.0	56.7
Net Ret.	659.0	657.2	1632.6	1516.6	235.6	243.5	675.8	589.2	41.5	157.1
B & H	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0
Diff.	-494.0	-495.8	479.6	363.6	-917.4	-909.5	-477.2	-563.8	-1111.5	-996.0
SLO										
NoT	389.0	211.0	150.0	106.0	97.0	71.0	126.0	84.0	96.0	64.0
Net Ret.	105.3	158.6	280.8	283.2	-102.0	-100.6	259.6	262.0	-72.2	-59.5
B & H	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7
Diff.	-1014.5	-961.1	-839.0	-836.6	-1221.8	-1220.4	-860.2	-857.7	-1191.9	-1179.2
TUR										
NoT	371.4	296.7	201.8	163.8	107.1	100.0	172.9	144.5	133.6	113.9
Net Ret.	375.7	402.4	356.0	350.9	293.5	297.4	312.6	302.1	218.7	197.7
B & H	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3
Diff.	-3740.6	-3713.9	-3760.3	-3765.4	-3822.8	-3818.9	-3803.7	-3814.2	-3897.6	-3918.6

The table details the number of trades (NoT) and the net return (Net Ret.) from following the moving average strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the short selling moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each moving average rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

Table 4.17A
Results for the Long – Only Moving Average Trading Strategy: Local Prices

	(1, 50, 0)	(1, 50, 1)	(1, 150, 0)	(1, 150, 1)	(5, 150, 0)	(5, 150, 1)	(1, 200, 0)	(1, 200, 1)	(2, 200, 0)	(2, 200, 1)
CRO										
NoT	198.5	140.0	105.5	75.0	58.5	47.0	87.5	68.0	68.0	52.5
Net Ret.	23.6	40.4	96.0	115.9	78.0	74.9	124.1	132.8	13.5	8.2
B & H	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1	169.1
Diff.	-145.5	-128.7	-73.1	-53.2	-91.1	-94.2	-45.1	-36.3	-155.6	-160.9
CZE										
NoT	90.9	71.8	48.4	38.6	36.6	31.1	38.1	32.6	39.6	33.2
Net Ret.	198.8	183.2	200.4	192.4	88.2	79.2	311.9	302.7	88.1	84.9
B & H	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9	216.9
Diff.	-18.1	-33.7	-16.5	-24.5	-128.7	-137.6	95.0	85.8	-128.8	-132.0
EST										
NoT	197.2	161.2	115.2	92.0	51.2	41.2	100.8	75.2	68.8	56.0
Net Ret.	-135.8	-125.2	-45.6	-26.8	91.6	116.5	-60.9	-26.4	76.0	80.5
B & H	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0	497.0
Diff.	-632.8	-622.2	-542.5	-523.7	-405.4	-380.5	-557.8	-523.3	-420.9	-416.4
HUN										
NoT	178.2	140.2	102.2	79.9	60.6	50.2	93.1	74.7	64.4	54.1
Net Ret.	-94.9	-108.4	-74.9	-81.0	80.7	56.2	-98.7	-80.5	53.9	62.7
B & H	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9	437.9
Diff.	-532.8	-546.3	-512.8	-518.9	-357.2	-381.7	-536.6	-518.4	-384.0	-375.1
POL										
NoT	203.0	155.9	99.8	76.6	47.8	41.1	75.9	61.2	61.8	49.7
Net Ret.	155.6	179.6	383.2	391.0	12.7	15.9	383.4	384.0	40.8	38.1
B & H	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3	294.3
Diff.	-138.7	-114.8	88.8	96.7	-281.6	-278.4	89.0	89.7	-253.6	-256.2

Table 4.17A (continued)
Results for the Long – Only Moving Average Trading Strategy: Local Prices

	(1, 50, 0)	(1, 50, 1)	(1, 150, 0)	(1, 150, 1)	(5, 150, 0)	(5, 150, 1)	(1, 200, 0)	(1, 200, 1)	(2, 200, 0)	(2, 200, 1)
ROM										
NoT	168.3	140.3	72.6	62.0	45.4	39.1	55.7	50.3	54.9	48.3
Net Ret.	388.3	393.1	430.7	436.9	45.3	36.9	894.4	894.8	23.8	26.0
B & H	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5	8489.5
Diff.	-8101.2	-8096.5	-8058.9	-8052.6	-8444.2	-8452.6	-7595.1	-7594.8	-8465.7	-8463.6
RUS										
NoT	83.2	68.6	45.0	39.2	32.6	29.0	37.4	32.8	33.5	28.9
Net Ret.	475.0	317.1	1167.7	1040.9	232.5	188.2	342.4	263.1	92.9	108.7
B & H	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0	1153.0
Diff.	-678.0	-835.9	14.6	-112.1	-920.5	-964.8	-810.6	-889.9	-1060.1	-1044.3
SLO										
NoT	195.0	106.0	76.0	54.0	49.0	36.0	64.0	43.0	49.0	33.0
Net Ret.	214.2	239.3	323.5	324.0	28.6	27.7	302.8	303.3	42.1	45.4
B & H	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7	1119.7
Diff.	-905.6	-880.4	-796.2	-795.8	-1091.1	-1092.0	-816.9	-816.4	-1077.6	-1074.4
TUR										
NoT	186.4	149.1	101.5	82.6	54.2	50.7	87.1	72.9	67.4	57.6
Net Ret.	423.8	435.1	452.3	434.4	265.7	280.5	414.0	391.0	207.2	184.4
B & H	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3	4116.3
Diff.	-3692.5	-3681.2	-3664.0	-3681.9	-3850.6	-3835.8	-3702.3	-3725.3	-3909.1	-3931.9

The table details the number of trades (NoT) and the net return (Net Ret.) from following the moving average strategy, as well as the buy and hold return (B & H) and the difference (Diff.) in profits from following the long – only moving average strategy and the corresponding buy – and – hold strategy for each of the 10 moving average rules examined in 9 CEE emerging stock markets over the 11 – year period 1997 – 2007. The table shows the results for each moving average rule averaged over the individual companies. The trading rules were implemented using share prices denominated in local currency. All returns are expressed in percentages.

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